CALFED Bay-Delta Program
Storage and Conveyance Refinement Process:

A Status Report on System Modeling Using DWRSIM

Hydrology and Operations Section
Modeling Support Branch
Office of State Water Project Planning
Department of Water Resources, Sacramento

September 24, 1997

CALFED Bay-Delta Program
Storage and Conveyance Refinement Process:

A Status Report on System Modeling Using DWRSIM

Hydrology and Operations Section
Modeling Support Branch
Office of State Water Project Planning
Department of Water Resources, Sacramento

September 24, 1997

CALFED Storage and Conveyance Refinement Process:
A Status Report on DWRSIM Model Studies

This brief report presents status of DWRSIM model studies activities since last quarterly report of June 25, 1997. Today's presentation has been subdivided into three parts.

a) Development of 2020 level of development hydrology to be presented by Tariq Kadir of DWR.

b) Development of new DWRSIM model features to meet CALFED Bay-Delta Program needs to be presented by Bill Smith of SWRI.

c) Overview of DWRSIM and status of requested model studies.

A list of requested DWRSIM is presented in Table 1. Model studies assumptions are presented in Appendix I. Details of study assumptions, inputs and results are also available on the DWR's Hydrology and Operations Section home page at the URL, http://wwwhydro.water.ca.gov/calfed.html. Study results in terms of water supply impacts are presented in Tables 2 through 11.

Key results from selected studies are also presented in several graphs and charts.

HYDROLOGY 2020-D09a USED IN CALFED STUDIES

Introduction

A major input to DWRSIM is the adjusted "historical hydrology". This input is determined from the hydrology development process using the "depletion analysis approach" to calculate the water supply upstream from the Delta at some specified level of development (Note: This applies to Sacramento Valley and Eastside Stream areas. For the San Joaquin Valley, the hydrology input is principally from the Bureau of Reclamation SANJASM model, with minor adjustments). The depletion studies are conducted using historically observed streamflow data, and hydrologies developed recently simulate the period 1922 through 1994.

Specific items determined in the hydrology development process are:

- o Local precipitation runoff as affected by assumed land use.
- o Operational releases from non-project reservoirs on tributaries flowing to the Delta service area. These releases must reflect proper operations criteria and facilities at the specified level of development.
- o Inflow to CVP and SWP project reservoirs as modified by upstream water use and local reservoir operations.
- o Specific releases from CVP and SWP reservoirs to meet contractual obligations to Central Valley floor water users.
- o Total water requirements of irrigated lands and urban areas on Central Valley floor.
- o Surface water diversions and ground water pumping to meet total water requirements.
- o Losses (recharge) from precipitation and surface water into Central Valley floor ground water basins.

All of these factors influence the water supply available to the Delta. In any given operation study, DWRSIM incorporates the depletion study results as input data and regulates the supply to meet various purposes. Detailed descriptions of the depletion study methodology are also available on request.

New Hydrology at the 2020 Level of Development

The Hydrology Development Unit has recently completed the development of a 2020 level hydrology HYD-D09a for use in DWRSIM planning studies. The major differences in developing this hydrology compared to the 1995-C06f hydrology (used in the previous set of studies for CALFED) are as follows:

1. Land Use:

2020-D09a: Land use projections at the 2020 level of development are based on Bulletin 160-98 estimates. This applies to all depletion areas in the valley floor north of the

Delta. For the Delta, 2020 projections from Bulletin 160-93 were used.

1995-C06f: Land use projections at the 1995 level of development are based on Bulletin 160-93 estimates.

2. Net Delta Water Requirements:

2020-D09a: Variable ET's (vary by month and by year) are used to calculate crop water requirements in the Delta.

1995-C06f: Constant ET's (vary by month but constant year to year) are used to calculate crop water requirements.

3. HEC-3 Models for Yuba, Bear, and American River systems:

2020-D09a: The historical period simulated is 1922-1994.

1995-C06f: The historical period simulated is 1922-1992.

4. Camanche/Pardee Operation on the Mokelumne River:

2020-D09a: EBMUD study 5977 is used.

1995-C06f: EBMUD study 5935 is used.

5. San Joaquin Valley Hydrology:

2020-D09a: Based on SANJASM run NF1 obtained from Bureau of Reclamation.

1995-C06f: Based on SANJASM run 4Sb obtained from Bureau of Reclamation.

Both SANJASM runs simulated 1922-1992, and DWR staff extended the data through 1994.

There were also some minor errors in the 1995-C06f that were corrected in the 2020-D09a hydrology.

The total Ag & Urban acreages for the valley floor areas are 4,690,000 acres and 4,450,000 acres for the 2020-D09a and 1995-C06f hydrologies, respectively.

The 1922-1994 long term projected inflows to the Delta (supply) are 20,870 TAF/year and 20,950 TAF/year for the 2020-D09a and 1995-C06f hydrologies, respectively.

The 1928-1934 projected inflow to the Delta (supply) are 11,090 TAF/year and 11,130 TAF/year for the 2020-D09a and 1995-C06f hydrologies, respectively.

D-007854

DWRSIM Modifications for CALFED

- ERPP
- Variable SWP Demand
- Stanislaus Operation
- In Delta Storage

SWRI SURFACE WATER RESOURCES, INC.

ERPP

10 day flow targets on all major river systems

Upper Sacramento River	**CP 151**
Lower Sacramento River	**CP 154**
Yuba River	**CP 152**
Feather River	**CP 153**
Merced River	**CP 156**
Toulumne River	**CP 155**
Stanislaus River	**CP 651**
Delta Outflow	**CP 158**

SWRI SURFACE WATER RESOURCES, INC.

D—007856

ERPP Assumptions

- **No impact on CVP/SWP operations**
- **Not used for other purposes**
- **Coincides with SJR pulse period**
- **Met from Environmental Storage**
  - *Portion of North Delta Surface Storage*
  - *New San Joaquin Basin Storage*
  - *Fills from "surplus"*
- **Met with purchase from willing seller**

SWRI SURFACE WATER RESOURCES, INC.

D—007857

ERPP Simulation

- "Post Processing" simulation
- Compute additional flow requirements
- Operate Environmental Storage
- Get water from willing sellers
- Route new flows to ocean
- Update Delta Parameters
  - *X2*
  - *Xchannel*
  - *G-model history*
  - *Qwest*
  - *Salinities*
  - *Vernalis Salinity*

SWRI SURFACE WATER RESOURCES, INC.

D—007858

Variable SWP Demand

- **Allows user input of SWP demands**
  - *At each Control Point*
  - *For each period of simulation*
  - *For each water type*
    - Agriculture (AG)
    - Municipal & Industrial (MI)
    - Interuptable Supply
- **Uses Corps of Engineers DSS Database technology**
- **Built utility programs to help generate database**

SWRI SURFACE WATER RESOURCES, INC.

D—007859

Revised Stanislaus Operation

- Stanislaus River fish flows
- Stockton East
- Oakdale/SSJID
- Central San Joaquin ID

SWRI SURFACE WATER RESOURCES, INC.

In Delta Storage

■ Fill

- *Last to fill (after NDGS and NDSS)*
- *Only surplus used*
- *Considered an export for export ratio computation*

■ Release

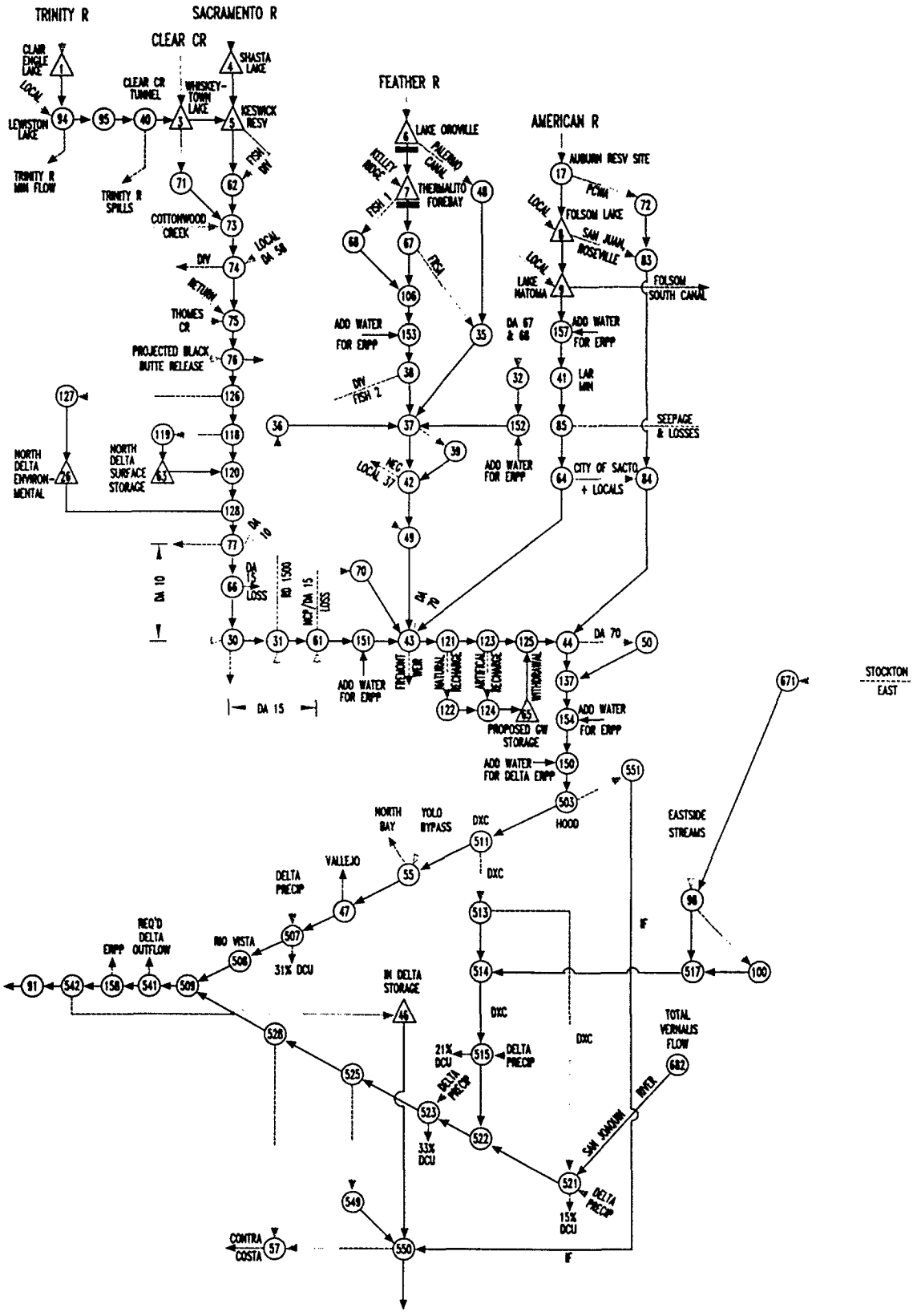
- *First to release*
- *Direct connection to export pumps*
- *Not counted as export for export ratio purposes*
- *Only to reduce upstream SWP releases for export*

SWRI SURFACE WATER RESOURCES, INC.

DWR PLANNING SIMULATION MODEL NETWORK REPRESENTATION

SACRAMENTO BASIN AND DELTA

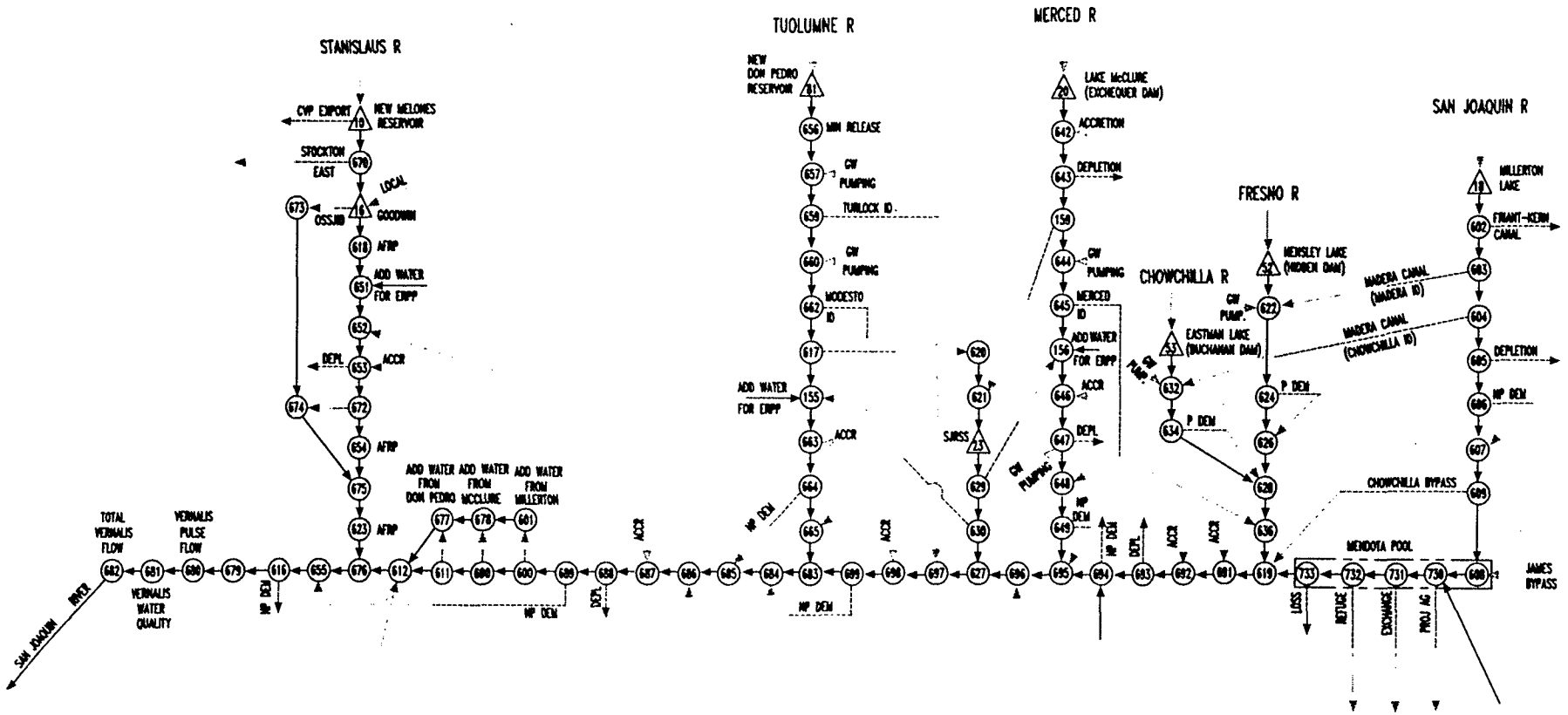
CALFED - September 10, 1997 Edition (Page 1 of 4)



D—007862

D-007862

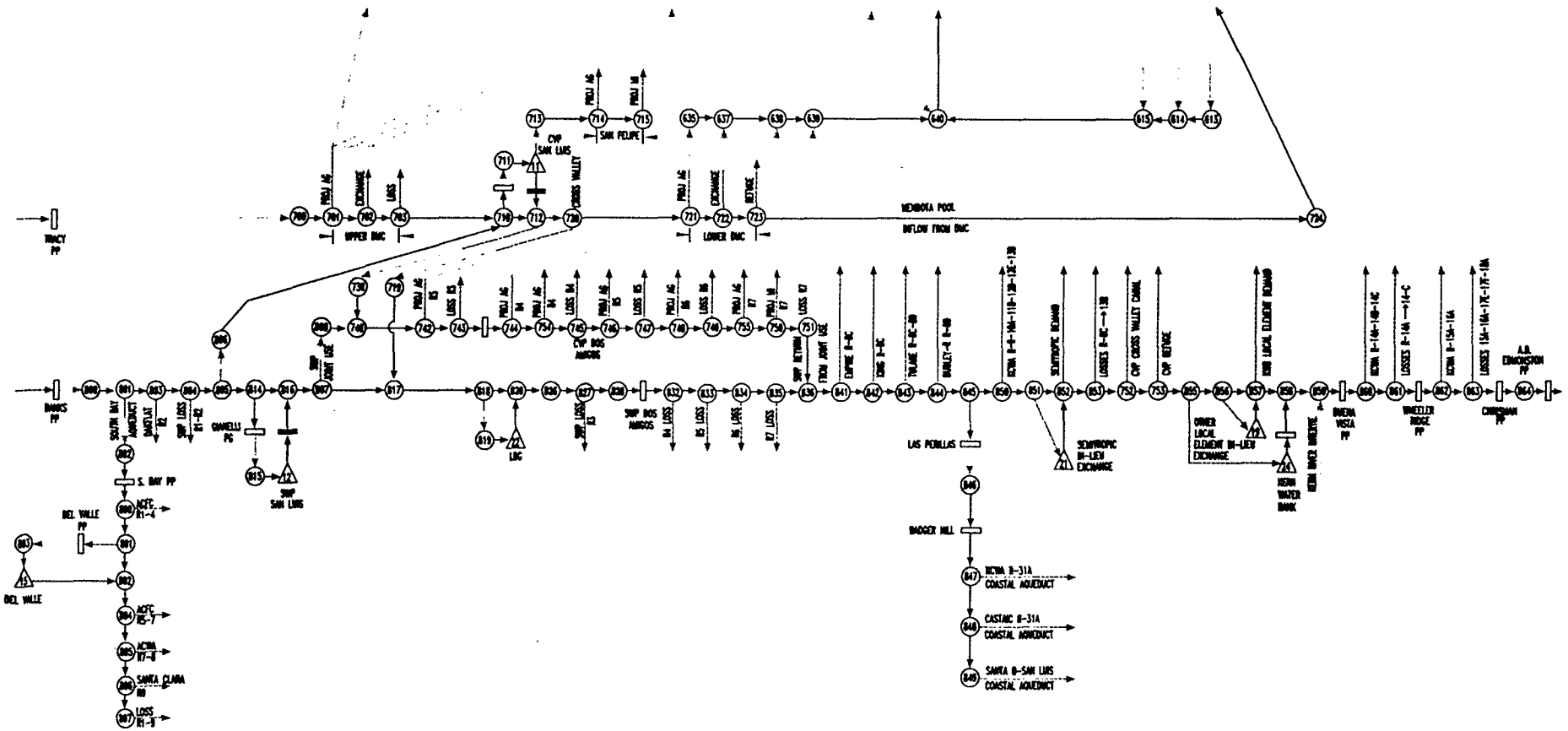
DWR PLANNING SIMULATION MODEL NETWORK REPRESENTATION
SAN JOAQUIN BASIN
CALFED - September 10, 1997 Edition (Page 2 of 4)



D—007863

DWR PLANNING SIMULATION MODEL NETWORK REPRESENTATION
AQUEDUCT AND DMC

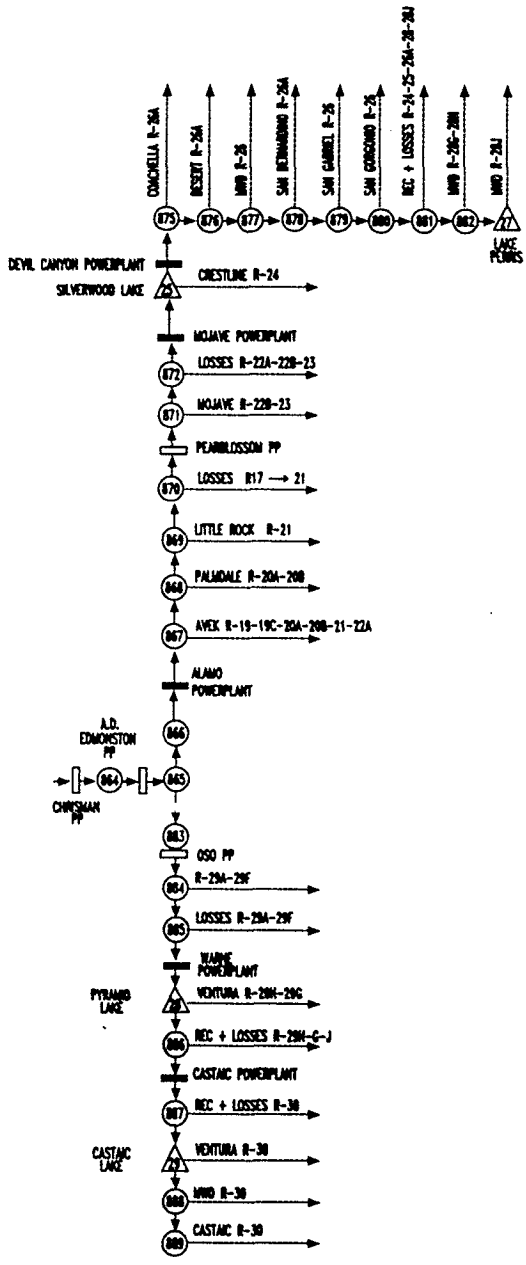
CALFED - September 10, 1997 Edition (Page 3 of 4)



D—007864

DWR PLANNING SIMULATION MODEL NETWORK REPRESENTATION
AQUEDUCT EAST AND WEST BRANCH

CALFED - September 10, 1997 Edition (Page 4 of 4)



D—007865

D-007865

OVERVIEW OF DWRSIM MODEL

General

- Simulates operation of CVP/SWP system reservoirs and conveyance facilities. San Joaquin River System incorporated within DWRSIM using USBR's SANJASM model data.

- Study period is water years 1992 - 1994, historical hydrology modified to reflect 2020 level of development consistent with DWR Draft Bull. 160-98.

- Model uses monthly time step. Delta standards are modeled on partial month basis, as prescribed in the WQCP '95.

- The model uses existing COA percentages for sharing storage withdrawals (75/25 for CVP/SWP) in-basis use, including X2 requirements, and sharing surplus flows (55/45 for CVP/SWP). An arbitrary sharing ratio of 50/50 was used whenever project exports are restricted.

- Application of model in a comparative mode (with and without scenarios) to estimate impacts of any proposal.

Recent Enhancements

- A new SWP and CVP south-of-Delta contractor delivery logic based on

  (I) runoff forecast information
  (ii) delivery versus carryover risk curve
  (iii) a standardized rule (water supply index versus demand index curve)
  (iv) updates of delivery levels monthly from January 1 through May 1 as water supply parameters become more certain.

- An expanded network schematic includes additional surface, ground water and in-Delta storage, isolated facility; more details in the Delta and along the DMC and SWP/CVP joint reach facility.

- Contra Costa Water District's "G" model is used to relate net Delta outflows and salinity.

- Simulation of Monterey Agreement between SWP contractors.

- Dynamic simulation of proposed CVP operation criteria.

TABLE 1
CALFED DWRSIM STUDIES AND KEY ASSUMPTIONS

A. D-1485 Base Study: Study 2020d09a-calfed-527

D-1485 Bay-Delta Standards
2020 level hydrology
SWP variable demand
Stanislaus Operation (USBR Interim Operation Plan)

B. Benchmark (Scenario 1a): Study 2020d09a-calfed-514

1995 WQCP Bay-Delta Standards
Selected Upstream AFRP in-stream flows

C. Benchmark Reoperation (Scenario 1b): Study 2020d09a-calfed-515a

Scenario 1a plus
- maximum wheeling of CVP water through SWP facilities

D. Benchmark Reoperation (Scenario 1c): Study 2020d09a-calfed-515

Scenario 1a plus
- maximum wheeling of CVP water through SWP facilities
- unmet CVP demands on SWP system

E. No Action (Scenario 1d): Study 2020d09a-calfed-516a

Scenario 1a plus
AFRP Delta Actions
a. April-May export restrictions
   - 1:3 below normal, dry & critical years
   - 1:4 above normal years
   - 1:5 wet years
b. More X2 days at Chipps Island in May-June
c. Delta Cross Channel closed November through June.

F. No Action (Scenario 1e): Study 2020d09a-calfed-516

Scenario 1a plus
AFRP in-stream flows below Goodwin Dam

AFRP Delta Actions

a. April-May export restrictions
   - 1:3 below normal, dry & critical years
   - 1:4 above normal years
   - 1:5 wet years

b. More X2 days at Chipps Island in May-June

c. Delta Cross Channel closed November through June.

✓**G. No Action with Reoperation (Scenario 1f): Study 2020d09a-calfed-517**

Scenario 1e plus
- maximum wheeling of CVP water through SWP facilities
- unmet CVP demand on SWP system

✓**H. No Action with Reoperation and ERPP (Scenario 1g): Study 2020d09a-calfed-518**

Scenario 1f plus
- ERPP flow targets

New Facility Scenarios (Scenarios 2-8)

Note: New Criteria

Isolated facility criteria
- included in E/I ratio and SJR April-May pulse ratio
- no constraint on IF diversions to total Delta export ratio (i.e., 100%)

Minimum through Delta exports
1000 cfs Oct-Mar and July-Sept
0 cfs Apr-June

✓**I. New Facility -SDI (Scenario 2): Study 2020d09a-calfed-528**

Scenario 1g plus
- South Delta Improvements (SDI)

✓**J. New Facility - IF (Scenario 6) : Study 2020d09a-calfed-529**

Scenario 2 plus
- 5,000 cfs Isolated Facility (IF)
- Delta Cross Channel gates closed from September through June and open July through August.

K. New Facilities - SDSS (Scenario 5): Study 2020d09a-calfed-530

Scenario 2 plus
- 2. MAF South of Delta Surface Storage (SDSS)
- 3500 cfs Inlet and Outlet capacities.

L. New Facilities - NDGS, NDSS, SDGS & SDSS (Scenario 3): Study 2020d09a-calfed-531

Scenario 2 plus
- 0.25 MAF North of Delta Groundwater Storage (NDGS)
- 3.0 MAF North of Delta Surface Storage (NDSS)
  - diversion and discharge capacities of 5,000 cfs
  - no new diversion in any given water year until a 60,000 cfs mean daily flow event occurred at Chico Landing
- 0.5 MAF South of Delta Groundwater Storage (SDGS)
- 1.0 MAF South of Delta Surface Storage (SDSS) with 3500 cfs inlet and outlet capacities.

M New Facilities - NDGS, NDSS, SDGS, SDSS & SJBSS (Scenario 4): Study 2020d09a-calfed-532

Scenario 2 plus
- All of the Scenario 3 facilities with
  - 2.0 MAF South of Delta Surface Storage (SDSS)
  - 0.24 MAF San Joaquin Basin Surface Storage (SJBSS)

N. New Facilities - IF and IDS (Scenario 7): Study 2020d09a-calfed-533

Scenario 4 plus
- 5,000 cfs Isolated Facility (IF)
- 0.2 MAF In Delta Storage (IDS)

O. New Facilities - IF and IDS (Scenario 8): Study 2020d09a-calfed-534

Scenario 4 plus
- 15,000 cfs Isolated Facility (IF)
- 0.2 MAF In Delta Storage (IDS)

TABLE 2
SUMMARY OF WATER SUPPLY IMPACTS (73-YEAR STUDY)

		2020D09A-CALFED-527	2020D09A-CALFED-514		
		Total (CVP & SWP)	Total (CVP & SWP)	Merced & Tuolumne Flows	Total Water Supply Impacts
I.	CRITICAL DRY PERIOD AVERAGES (May 1928 - Oct 1934)				
A..	(1) Total Delta Exports (TAF/yr)	5260	4410		-850
	(2) Net Storage Used (TAF/yr)	1289	1211		78
	(3) Additional Tuolumne & Merced Pulse Flows (TAF/y)	0	101	-101	-101
	Total Water Supply Impact (TAF/yr) (1+2+3)				-873
B.	Total Delta Outflow (TAF/Yr)	4132	4936		804
II.	73-YEAR (1922 - 1994) AVERAGES				
A..	Total Delta Exports (TAF/yr)	6662	6392		-270
B.	Additional Tuolumne & Merced Pulse Flows (TAF/yr)	0	22	-22	-22
	Total Water Supply Impact (TAF/yr) (A+B)				-292
C.	Avg C.O. Storage Sac Basin (TAF)	7355	6908		-447
D.	Avg C.O. Storage New Melones (TAF)	1380	1280		-100
E.	Total Delta Outflow (TAF/yr)	13987	14274		287

PRELIMINARY

SUBJECT TO REVISION

TABLE 3
SUMMARY OF WATER SUPPLY IMPACTS (73-YEAR STUDY)

			2020D09A-CALFED-514	2020D09A-CALFED-515		
			Total (CVP & SWP)	Total (CVP & SWP)	Merced & Tuolumne Flows	Total Water Supply Impacts
I.	CRITICAL DRY PERIOD AVERAGES (May 1928 - Oct 1934)					
	A..	(1) Total Delta Exports (TAF/yr)	4410	4402		-8
		(2) Net Storage Used (TAF/yr)	1211	1212		-1
		(3) Additional Tuolumne & Merced Pulse Flows (TAF/y)	101	101	0	0
		Total Water Supply Impact (TAF/yr) (1+2+3)				-9
	B.	Total Delta Outflow (TAF/Yr)	4936	4944		8
II.	73-YEAR (1922 - 1994) AVERAGES					
	A..	Total Delta Exports (TAF/yr)	6392	6425		33
	B.	Additional Tuolumne & Merced Pulse Flows (TAF/yr)	22	22	0	0
		Total Water Supply Impact (TAF/yr) (A+B)				33
	C.	Avg C.O. Storage Sac Basin (TAF)	6908	6902		-6
	D.	Avg C.O. Storage New Melones (TAF)	1280	1280		0
	E.	Total Delta Outflow (TAF/yr)	14274	14241		-33

PRELIMINARY

SUBJECT TO REVISION

TABLE 4
SUMMARY OF WATER SUPPLY IMPACTS (73-YEAR STUDY)

		2020D09A-CALFED-514	2020D09A-CALFED-516		
		Total (CVP & SWP)	Total (CVP & SWP)	Merced & Tuolumne Flows	Total Water Supply Impacts
I.	CRITICAL DRY PERIOD AVERAGES (May 1928 - Oct 1934)				
A..	(1) Total Delta Exports (TAF/yr)	4410	4367		-43
	(2) Net Storage Used (TAF/yr)	1211	1195		16
	(3) Additional Tuolumne & Merced Pulse Flows (TAF/y)	101	91	10	10
	Total Water Supply Impact (TAF/yr) (1+2+3)				-17
B.	Total Delta Outflow (TAF/Yr)	4936	5038		102
II.	73-YEAR (1922 - 1994) AVERAGES				
A..	Total Delta Exports (TAF/yr)	6392	6313		-79
B.	Additional Tuolumne & Merced Pulse Flows (TAF/yr)	22	29	-7	-7
	Total Water Supply Impact (TAF/yr) (A+B)				-86
C.	Avg C.O. Storage Sac Basin (TAF)	6908	6873		-35
D.	Avg C.O. Storage New Melones (TAF)	1280	1016		-264
E.	Total Delta Outflow (TAF/yr)	14274	14378		104

PRELIMINARY

SUBJECT TO REVISION

TABLE 5
SUMMARY OF WATER SUPPLY IMPACTS (73-YEAR STUDY)

			2020D09A-CALFED-514	2020D09A-CALFED-517		
			Total (CVP & SWP)	Total (CVP & SWP)	Merced & Tuolumne Flows	Total Water Supply Impacts
I.	CRITICAL DRY PERIOD AVERAGES (May 1928 - Oct 1934)					
	A..	(1) Total Delta Exports (TAF/yr)	4410	4379		-31
		(2) Net Storage Used (TAF/yr)	1211	1190		21
		(3) Additional Tuolumne & Merced Pulse Flows (TAF/y)	101	91	10	10
		Total Water Supply Impact (TAF/yr) (1+2+3)				0
	B.	Total Delta Outflow (TAF/Yr)	4936	5021		85
II.	73-YEAR (1922 - 1994) AVERAGES					
	A..	Total Delta Exports (TAF/yr)	6392	6362		-30
	B.	Additional Tuolumne & Merced Pulse Flows (TAF/yr)	22	28	-6	-6
		Total Water Supply Impact (TAF/yr) (A+B)				-36
	C.	Avg C.O. Storage Sac Basin (TAF)	6908	6844		-64
	D.	Avg C.O. Storage New Melones (TAF)	1280	1015		-265
	E.	Total Delta Outflow (TAF/yr)	14274	14330		56

PRELIMINARY

SUBJECT TO REVISION

TABLE 6
SUMMARY OF WATER SUPPLY IMPACTS (73-YEAR STUDY)

		2020D09A-CALFED-514	2020D09A-CALFED-518		
		Total (CVP & SWP)	Total (CVP & SWP)	Merced & Tuolumne Flows	Total Water Supply Impacts
I.	CRITICAL DRY PERIOD AVERAGES (May 1928 - Oct 1934)				
A..	(1) Total Delta Exports (TAF/yr)	4410	4381		-29
	(2) Net Storage Used (TAF/yr)	1211	1199		12
	(3) Additional Tuolumne & Merced Pulse Flows (TAF/yr)	101	91	10	10
	Total Water Supply Impact (TAF/yr) (1+2+3)				-7
B.	Total Delta Outflow (TAF/Yr)	4936	5105		169
II.	73-YEAR (1922 - 1994) AVERAGES				
A..	Total Delta Exports (TAF/yr)	6392	6361		-31
B.	Additional Tuolumne & Merced Pulse Flows (TAF/yr)	22	28	-6	-6
	Total Water Supply Impact (TAF/yr) (A+B)				-37
C.	Avg C.O. Storage Sac Basin (TAF)	6908	6850		-58
D.	Avg C.O. Storage New Melones (TAF)	1280	1015		-265
E.	Total Delta Outflow (TAF/yr)	14274	14482		208

PRELIMINARY

SUBJECT TO REVISION

TABLE 7
SUMMARY OF WATER SUPPLY IMPACTS (73-YEAR STUDY)

		2020D09A-CALFED-514	2020D09A-CALFED-528		
		Total (CVP & SWP)	Total (CVP & SWP)	Merced & Tuolumne Flows	Total Water Supply Impacts
I.	CRITICAL DRY PERIOD AVERAGES (May 1928 - Oct 1934)				
A..	(1) Total Delta Exports (TAF/yr)	4410	4472		62
	(2) Net Storage Used (TAF/yr)	1211	1202		9
	(3) Additional Tuolumne & Merced Pulse Flows (TAF/y)	101	91	10	10
	Total Water Supply Impact (TAF/yr) (1+2+3)				81
B.	Total Delta Outflow (TAF/Yr)	4936	5023		87
II.	73-YEAR (1922 - 1994) AVERAGES				
A..	Total Delta Exports (TAF/yr)	6392	6601		209
B.	Additional Tuolumne & Merced Pulse Flows (TAF/yr)	22	29	-7	-7
	Total Water Supply Impact (TAF/yr) (A+B)				202
C.	Avg C.O. Storage Sac Basin (TAF)	6908	6738		-170
D.	Avg C.O. Storage New Melones (TAF)	1280	1015		-265
E.	Total Delta Outflow (TAF/yr)	14274	14249		-25

PRELIMINARY

SUBJECT TO REVISION

TABLE 8
SUMMARY OF WATER SUPPLY IMPACTS (73-YEAR STUDY)

		2020D09A-CALFED-514	2020D09A-CALFED-529		
		Total (CVP & SWP)	Total (CVP & SWP)	Merced & Tuolumne Flows	Total Water Supply Impacts
I.	CRITICAL DRY PERIOD AVERAGES (May 1928 - Oct 1934)				
A..	(1) Total Delta Exports (TAF/yr)	4410	4308		-102
	(2) Net Storage Used (TAF/yr)	1211	1191		20
	(3) Additional Tuolumne & Merced Pulse Flows (TAF/y)	101	91	10	10
	Total Water Supply Impact (TAF/yr) (1+2+3)				-72
B.	Total Delta Outflow (TAF/Yr)	4936	5169		233
II.	73-YEAR (1922 - 1994) AVERAGES				
A..	Total Delta Exports (TAF/yr)	6392	6575		183
B.	Additional Tuolumne & Merced Pulse Flows (TAF/yr)	22	29	-7	-7
	Total Water Supply Impact (TAF/yr) (A+B)				176
C.	Avg C.O. Storage Sac Basin (TAF)	6908	6713		-195
D.	Avg C.O. Storage New Melones (TAF)	1280	1015		-265
E.	Total Delta Outflow (TAF/yr)	14274	14273		-1

PRELIMINARY

SUBJECT TO REVISION

TABLE 9
SUMMARY OF WATER SUPPLY IMPACTS (73-YEAR STUDY)

		2020D09A-CALFED-514	2020D09A-CALFED-530		
		Total (CVP & SWP)	Total (CVP & SWP)	Merced & Tuolumne Flows	Total Water Supply Impacts
I.	CRITICAL DRY PERIOD AVERAGES (May 1928 - Oct 1934)				
A..	(1) Total Delta Exports (TAF/yr)	4410	4493		83
	(2) Net Storage Used (TAF/yr)	1211	1203		8
	(3) Additional Tuolumne & Merced Pulse Flows (TAF/y)	101	91	10	10
B.	Total Delta Outflow (TAF/Yr)	4936	4997		61
II.	73-YEAR (1922 - 1994) AVERAGES				
A..	Total Delta Exports (TAF/yr)	6392	6754		362
B.	Additional Tuolumne & Merced Pulse Flows (TAF/yr)	22	28	-6	-6
C.	Avg C.O. Storage Sac Basin (TAF)	6908	6742		-166
D.	Avg C.O. Storage New Melones (TAF)	1280	1016		-264
E.	Total Delta Outflow (TAF/yr)	14274	14093		-181

PRELIMINARY

SUBJECT TO REVISION

TABLE 10
SUMMARY OF WATER SUPPLY IMPACTS (73-YEAR STUDY)

		2020D09A-CALFED-514	2020D09A-CALFED-531		
		Total (CVP & SWP)	Total (CVP & SWP)	Merced & Tuolumne Flows	Total Water Supply Impacts
I.	CRITICAL DRY PERIOD AVERAGES (May 1928 - Oct 1934)				
A..	(1) Total Delta Exports (TAF/yr)	4410	4674		264
	(2) Net Storage Used (TAF/yr)	1211	1358		-147
	(3) Additional Tuolumne & Merced Pulse Flows (TAF/y)	101	92	9	9
B.	Total Delta Outflow (TAF/Yr)	4936	4972		36
II.	73-YEAR (1922 - 1994) AVERAGES				
A..	Total Delta Exports (TAF/yr)	6392	6866		474
B.	Additional Tuolumne & Merced Pulse Flows (TAF/yr)	22	28	-6	-6
C.	Avg C.O. Storage Sac Basin (TAF)	6908	8197		1289
D.	Avg C.O. Storage New Melones (TAF)	1280	1016		-264
E.	Total Delta Outflow (TAF/yr)	14274	13908		-366

PRELIMINARY

SUBJECT TO REVISION

Table 11
PRELIMINARY DWRSIM STUDY RESULTS
WATER SUPPLY BENEFITS OF CALFED STORAGE & CONVEYANCE FACILITIES

Study Information			Storage/Conveyance	SWP & CVP Deliveries (TAF/yr) [1] Total		SWP Interruptible	
ID	Ver	Date	Components	critical	73-yr	critical	73-yr
527	9.04	9/21/97	D-1485	948	329	-33	-56
515	9.04	9/21/97	B.M.+Max Wheeling+Surrogate	-32	62	19	-19
516	9.04	9/21/97	B.M.+Delta Actions	-45	-35	5	-37
517	9.04	9/21/97	B.M.+Delta Actions+Max Wheeling +Surrogate	-35	52	3	-59
518	9.04	9/21/97	Study 517+ERPP	-65	48	26	-57
528	9.04	9/21/97	Study 518+SDI	32	96	53	117
529	9.04	9/21/97	Stusy 518+SDI+5,000cfs IF	-118	71	68	116
530	9.04	9/21/97	Study518+SDI+SDSS	400	378	-33	-58
531	9.04	9/21/97	Study518+SDI+NDSS+NDES+SDSS+NDGS+SDGS	487	552	-33	-88

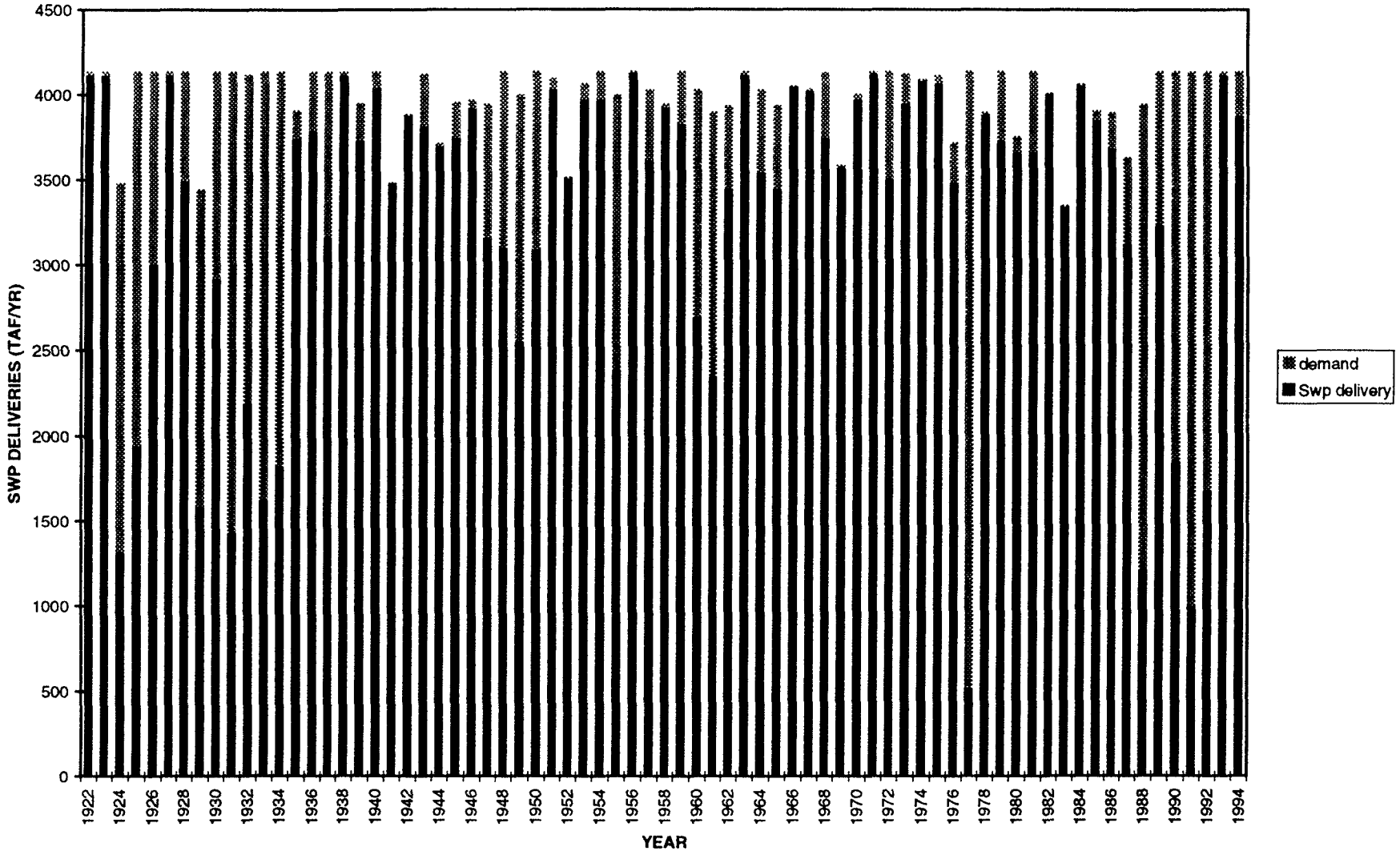
[1] Benefits measured against Study 514 benchmark

GRAPHICAL RESULTS FROM SELECTED STUDIES

PRELIMINARY

SUBJECT TO REVISION

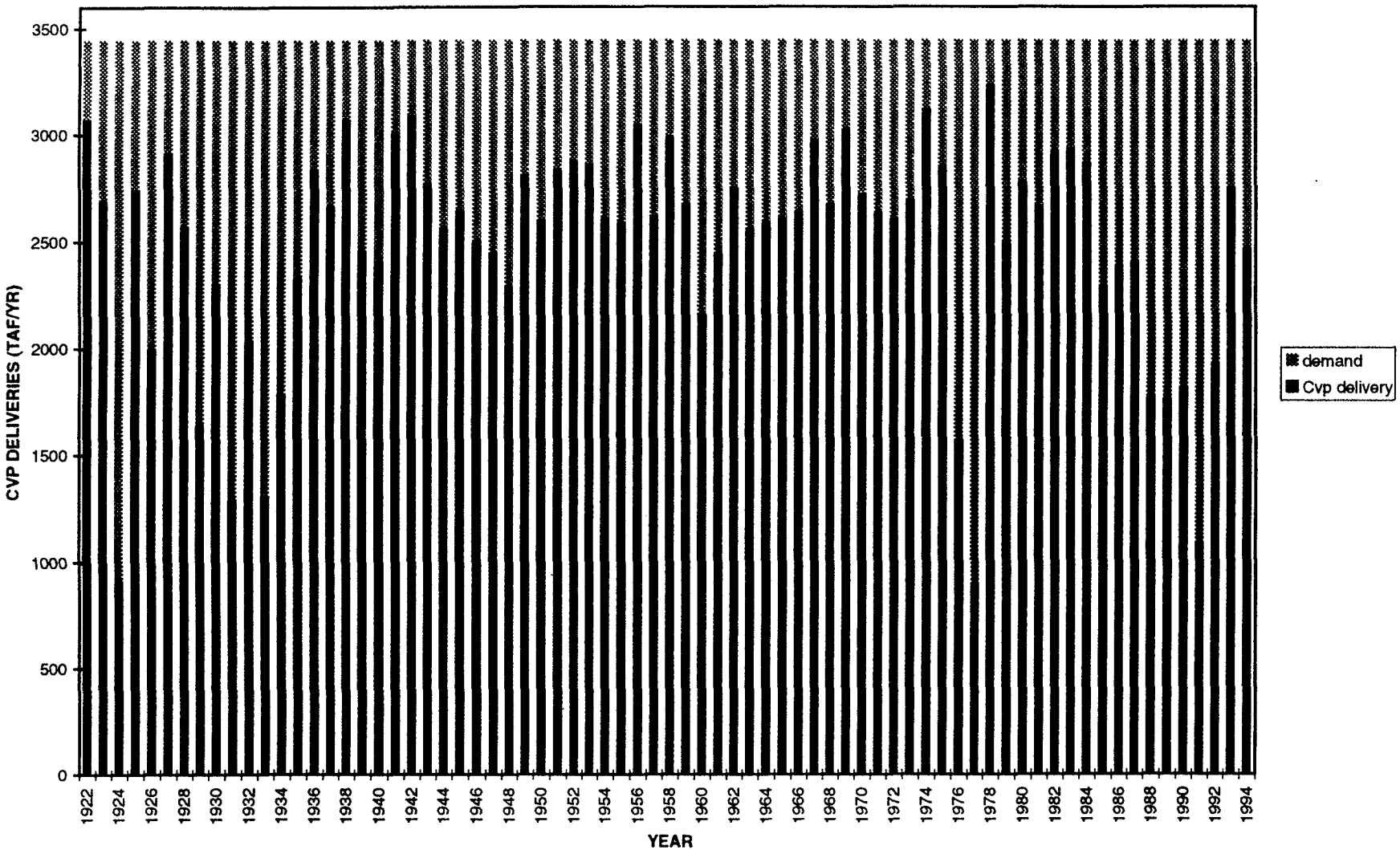
SWP DEMAND AND DELIVERY
(No Action scenario ie 2020d09a-calfed-516)



PRELIMINARY

SUBJECT TO REVISION

CVP DEMAND AND DELIVERY
(No Action Scenario 1e 2020do9a-calfed-516)

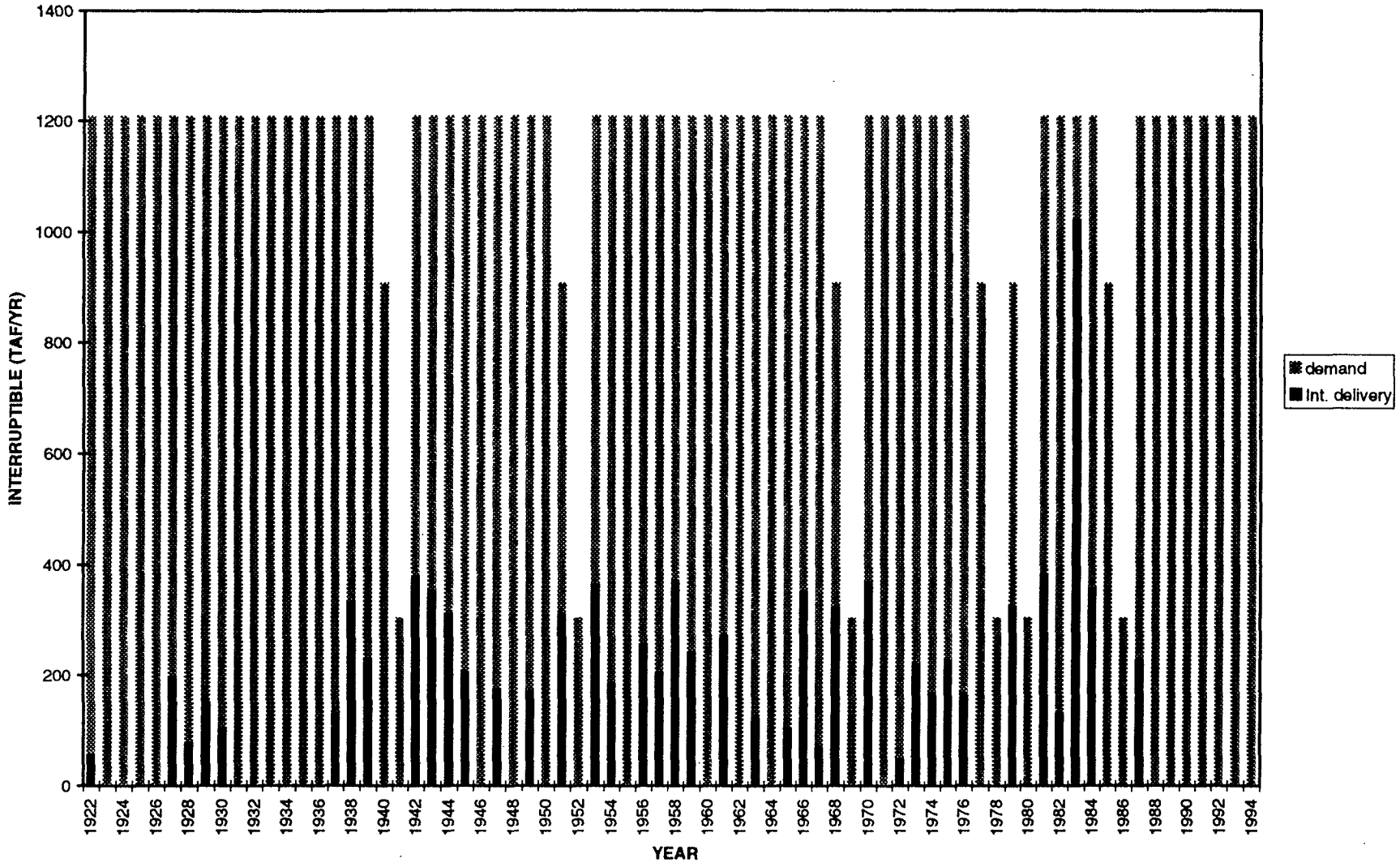


PRELIMINARY

SUBJECT TO REVISION

D—007882

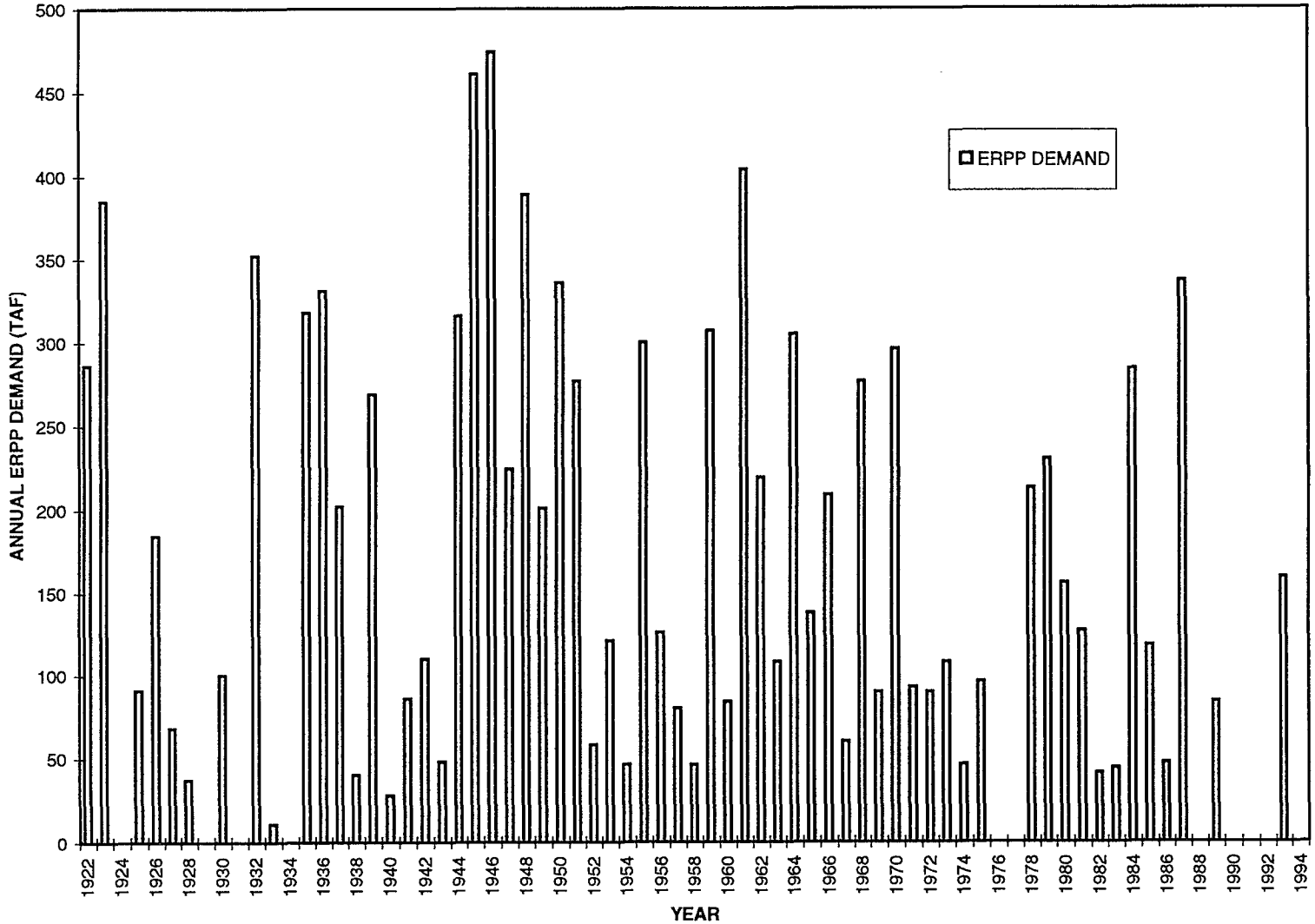
SWP INTERRUPTIBLE DEMAND AND DELIVERY
(No Action Scenario 1e 2020d09a-calfed-516)



PRELIMINARY

SUBJECT TO REVISION

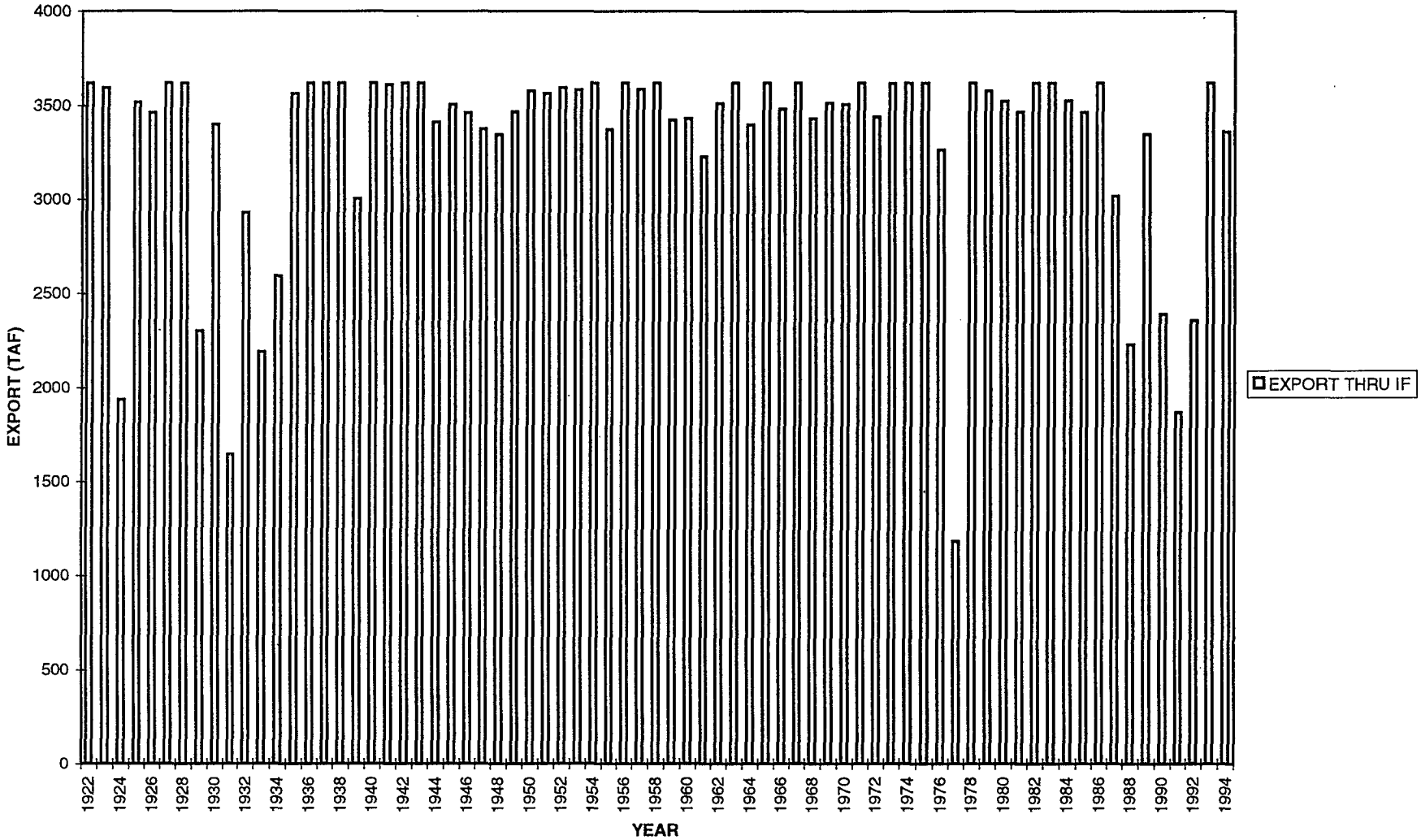
ERPP DEMAND
CALFED NO ACTION WITH REOPEARTION (SCENARIO 1G)
2020DC9A-CALFED-518



PRELIMINARY

SUBJECT TO REVISION

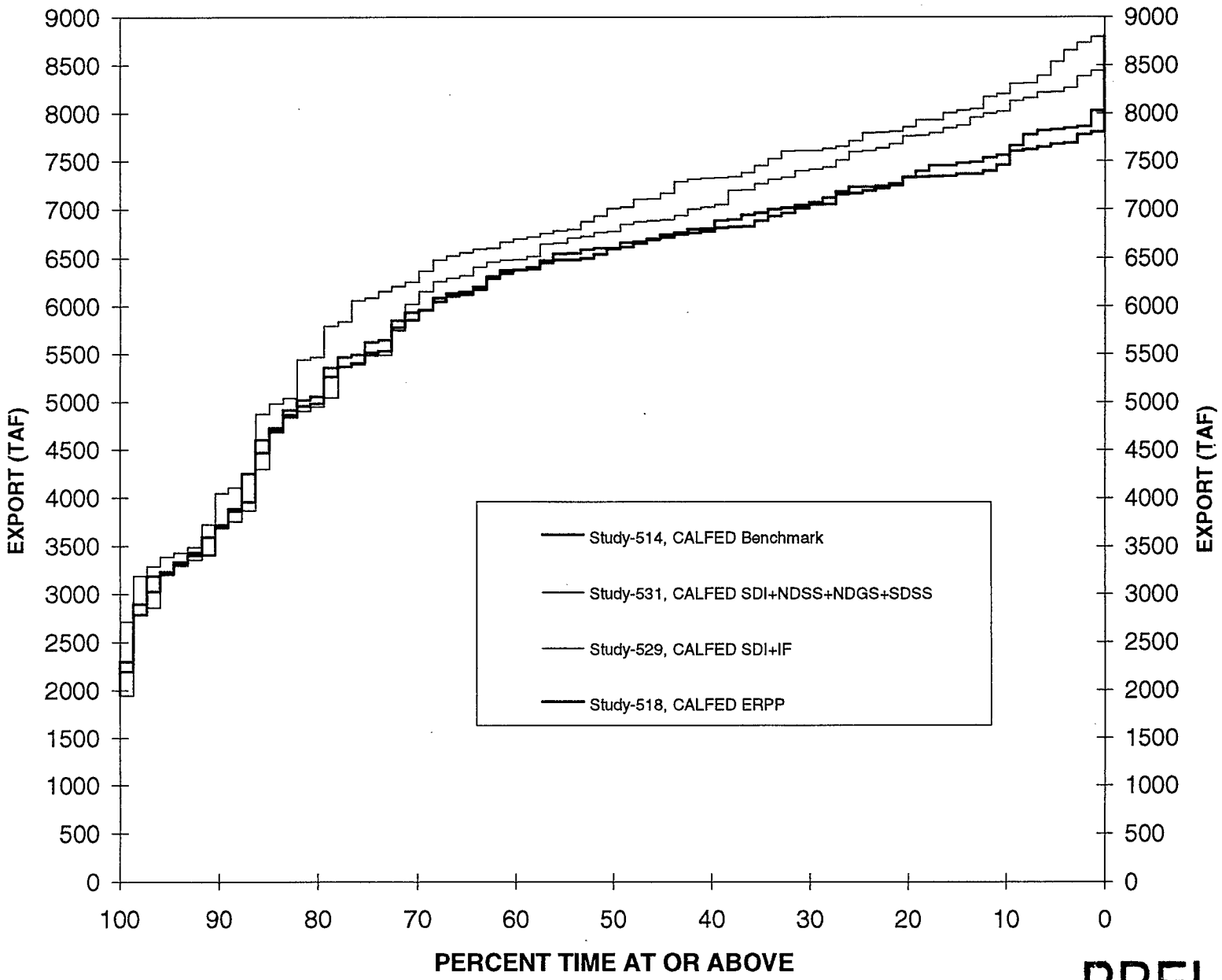
EXPORTS THROUGH ISOLATED FACILITY
CALFED 5,000 CFS IF (SCENARIO 6)
STUDY 2020D09A-CALFED-529



PRELIMINARY

SUBJECT TO REVISION

FREQUENCY OF ANNUAL BANKS AND TRACY EXPORT

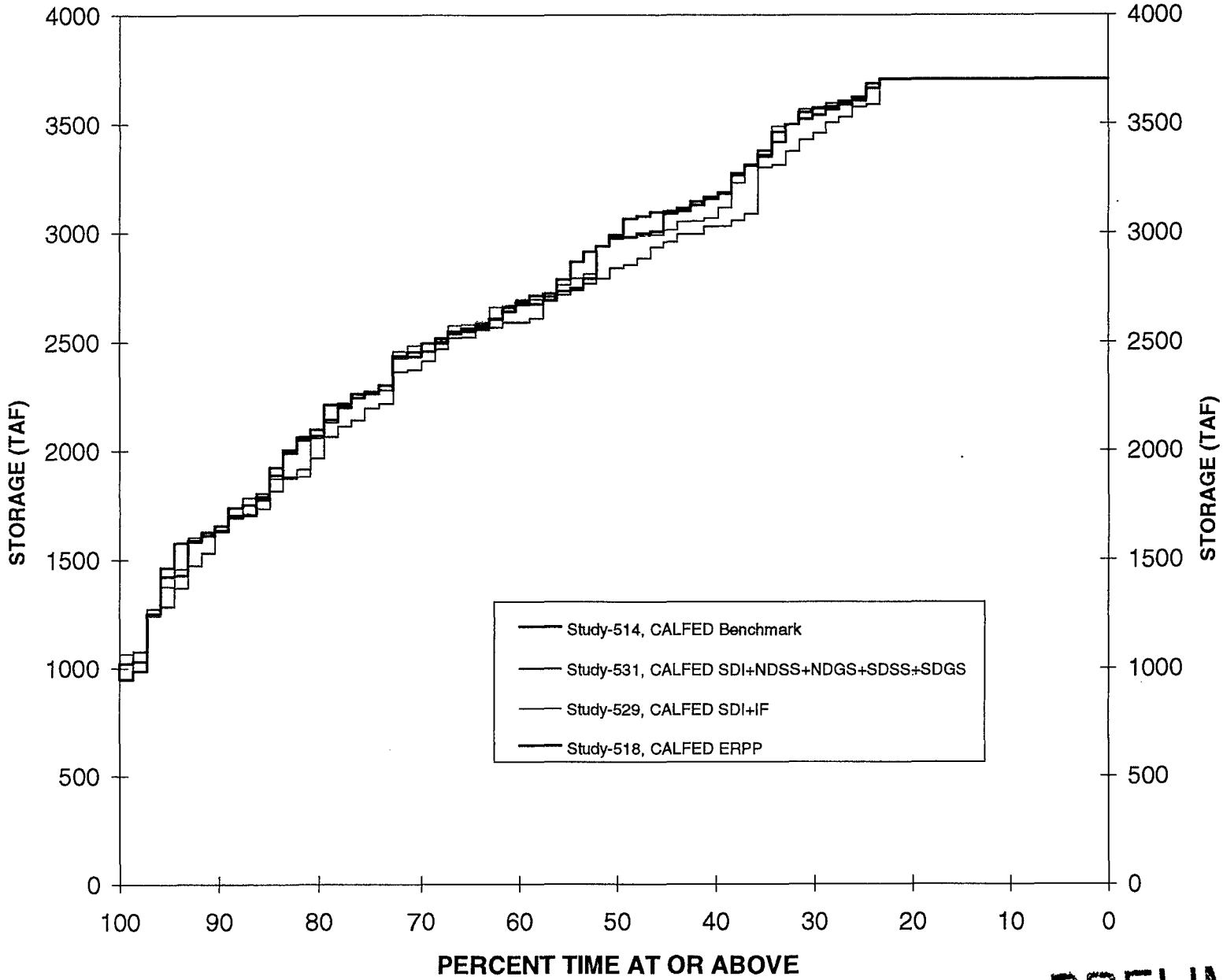


PRELIMINARY

SUBJECT TO REVISION

D-007886

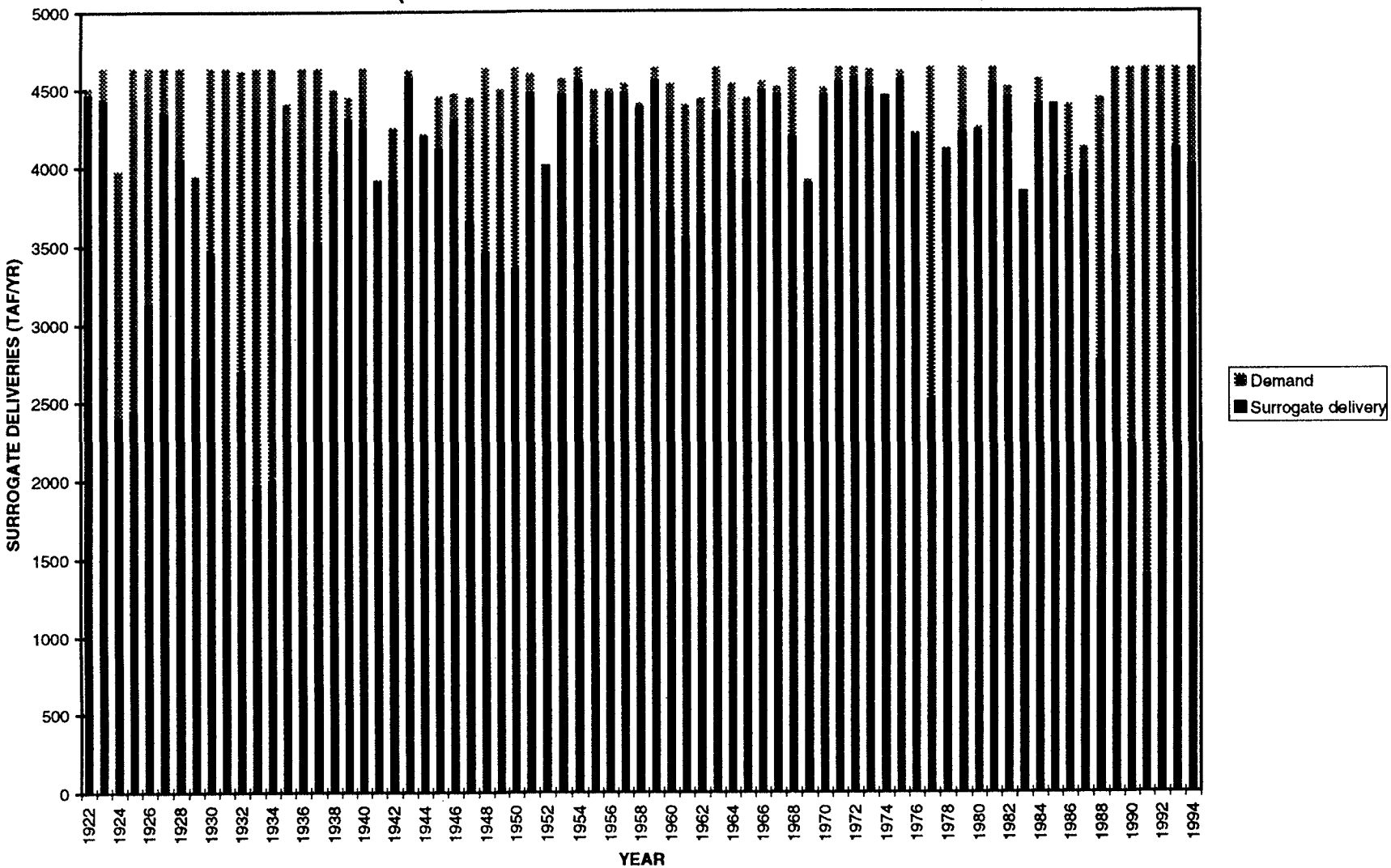
FREQUENCY OF END OF SEPTEMBER SHASTA STORAGE



PRELIMINARY

SUBJECT TO REVISION

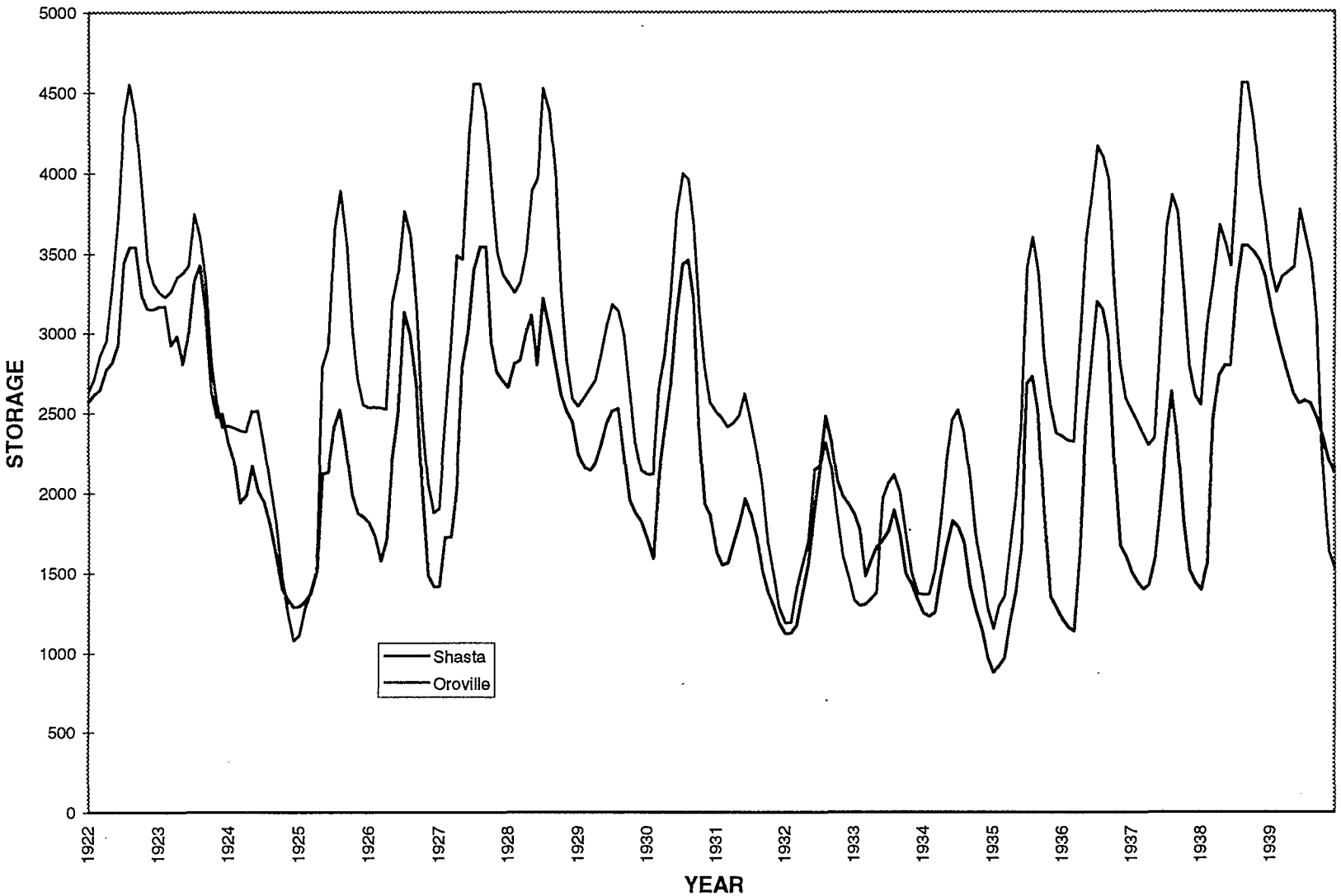
SURROGATE DEMAND AND DELIVERY
(2020D09A-CALFED-531 SDI+NDSS+NDGS+SDSS+SDGS)



PRELIMINARY

SUBJECT TO REVISION

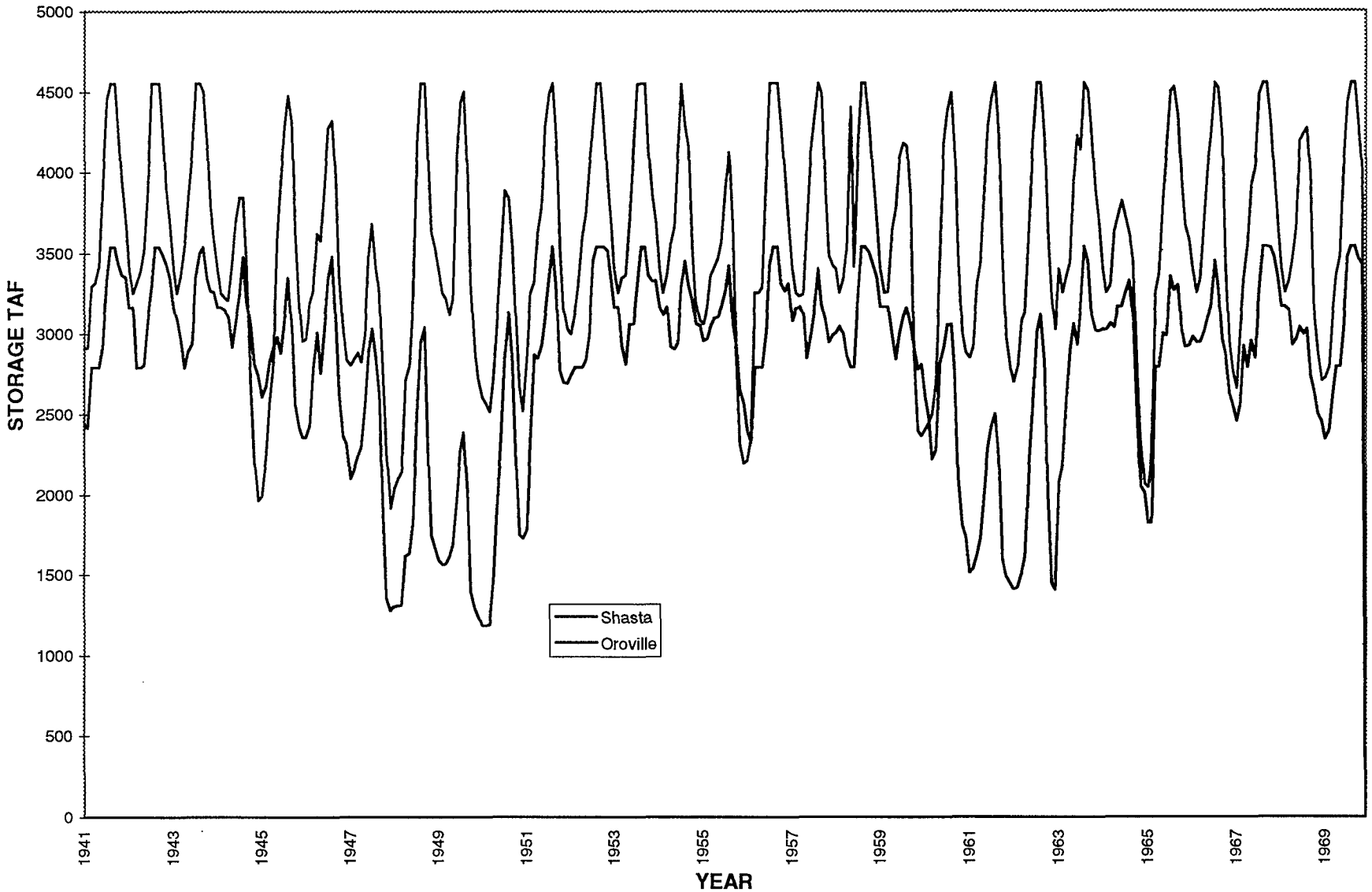
END OF MONTH STORAGE SCENARIO 3 (2020d09a-calfed-531)



PRELIMINARY

SUBJECT TO REVISION

END OF MONTH STORAGE SCENARIO 3 (2020d09a-calfed-531)

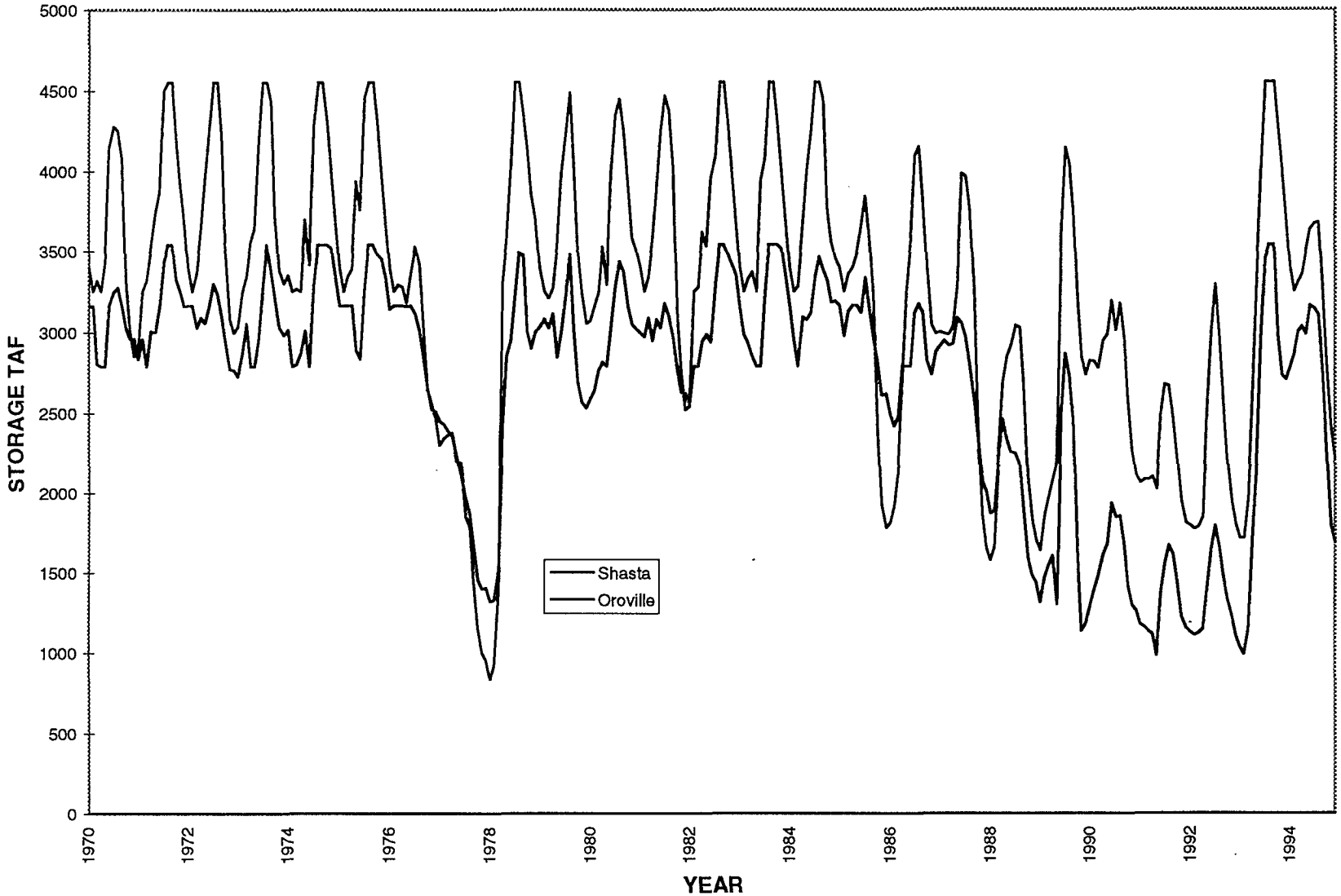


PRELIMINARY

SUBJECT TO REVISION

D—007890

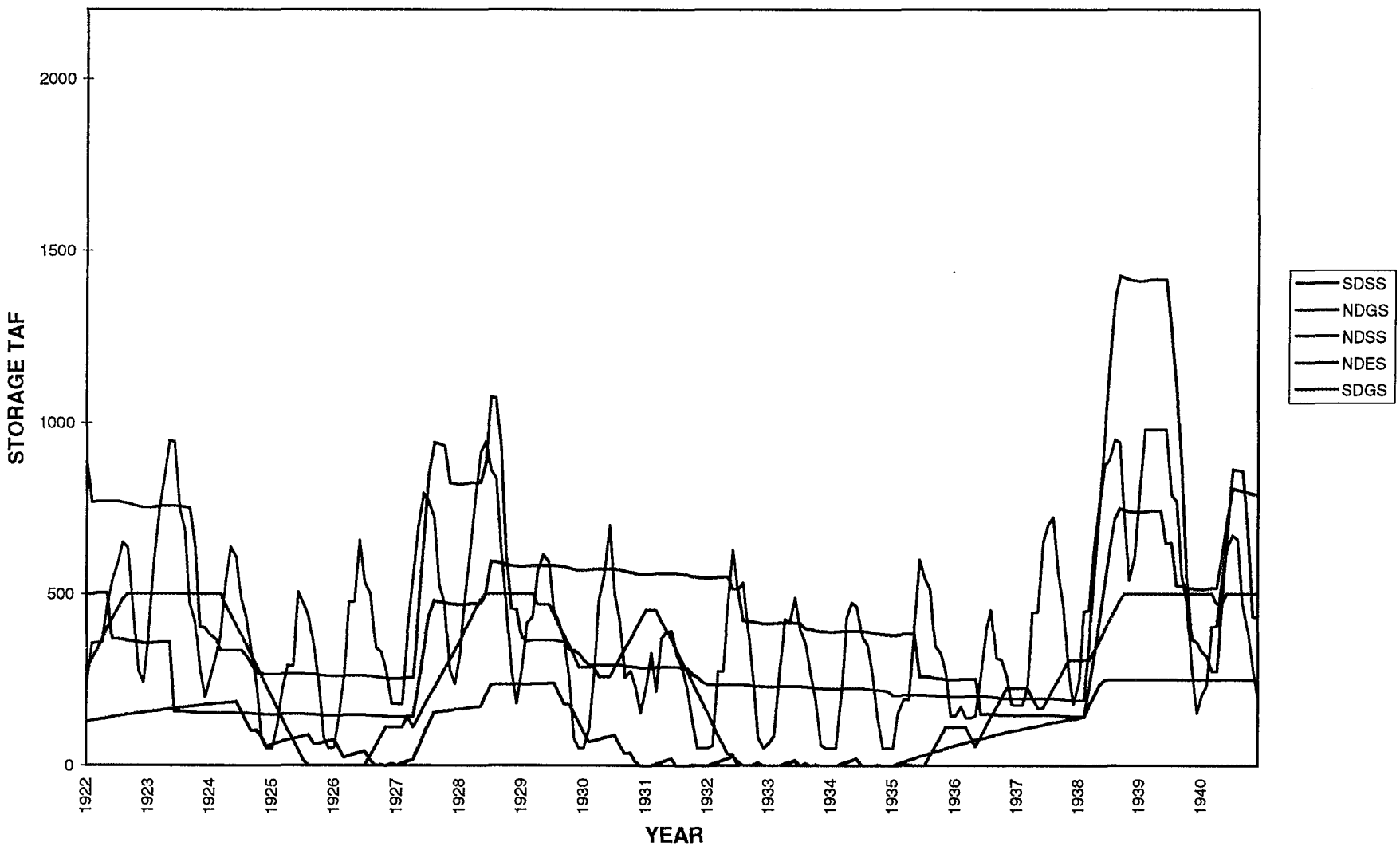
END OF MONTH STORAGE SCENARIO 3 (2020d09a-calfed-531)



PRELIMINARY

SUBJECT TO REVISION

END OF MONTH STORAGE SCENARIO 3 (2020d09a-calfed-531)

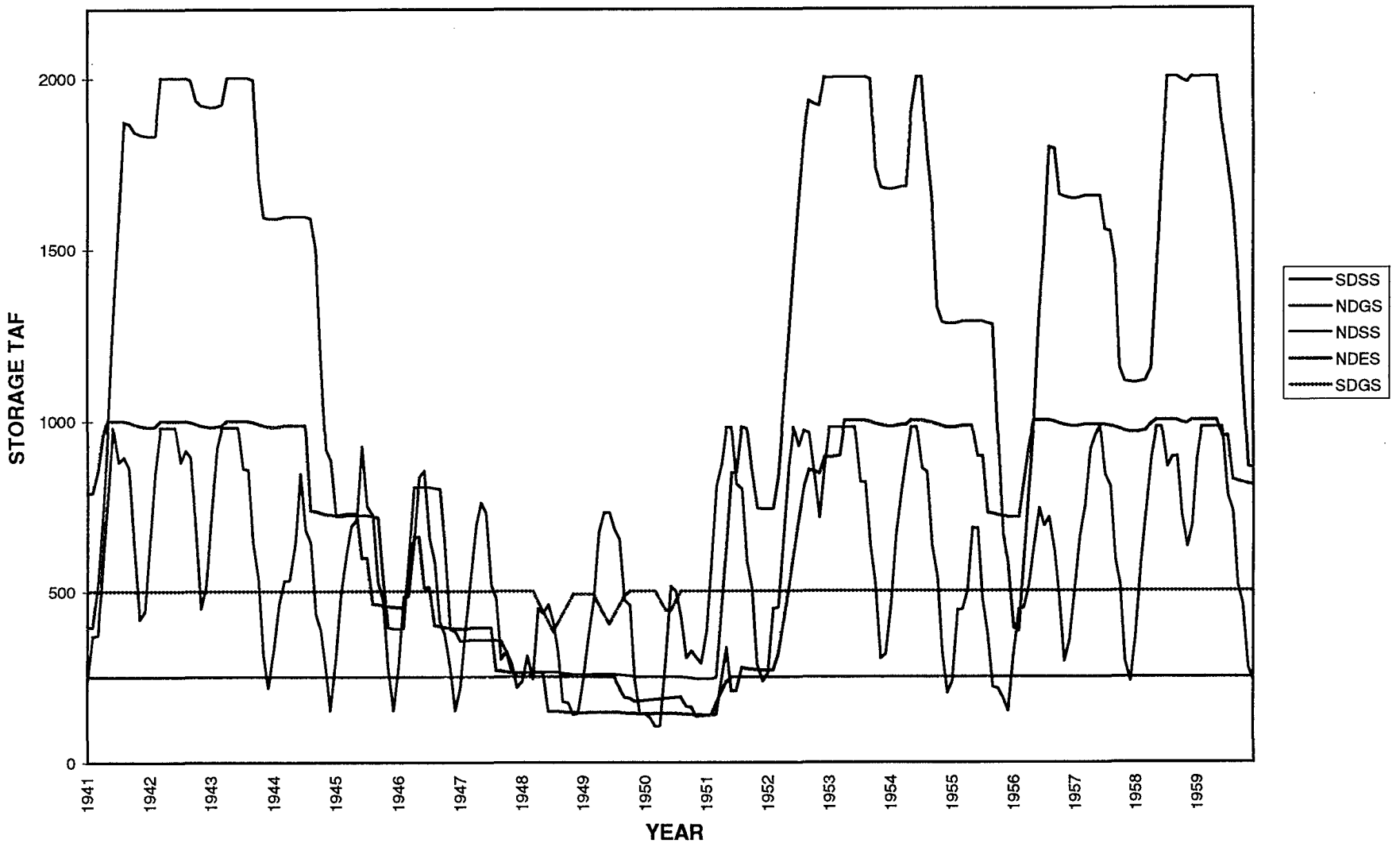


PRELIMINARY

SUBJECT TO REVISION

D-007892

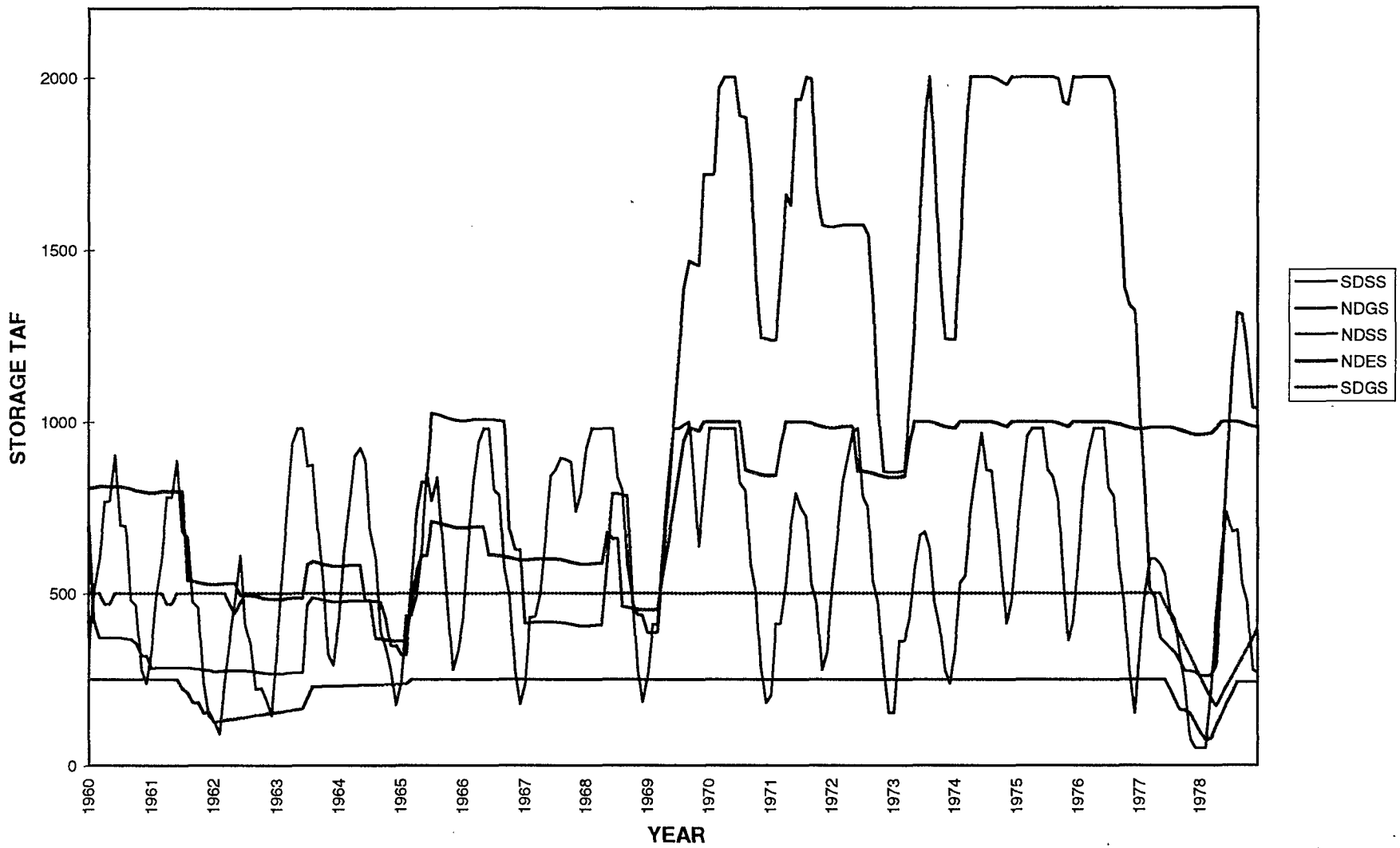
END OF MONTH STORAGE SCENARIO 3 (2020d09a-calfed-531)



PRELIMINARY

SUBJECT TO REVISION

END OF MONTH STORAGE SCENARIO 3 (2020d09a-calfed-531)

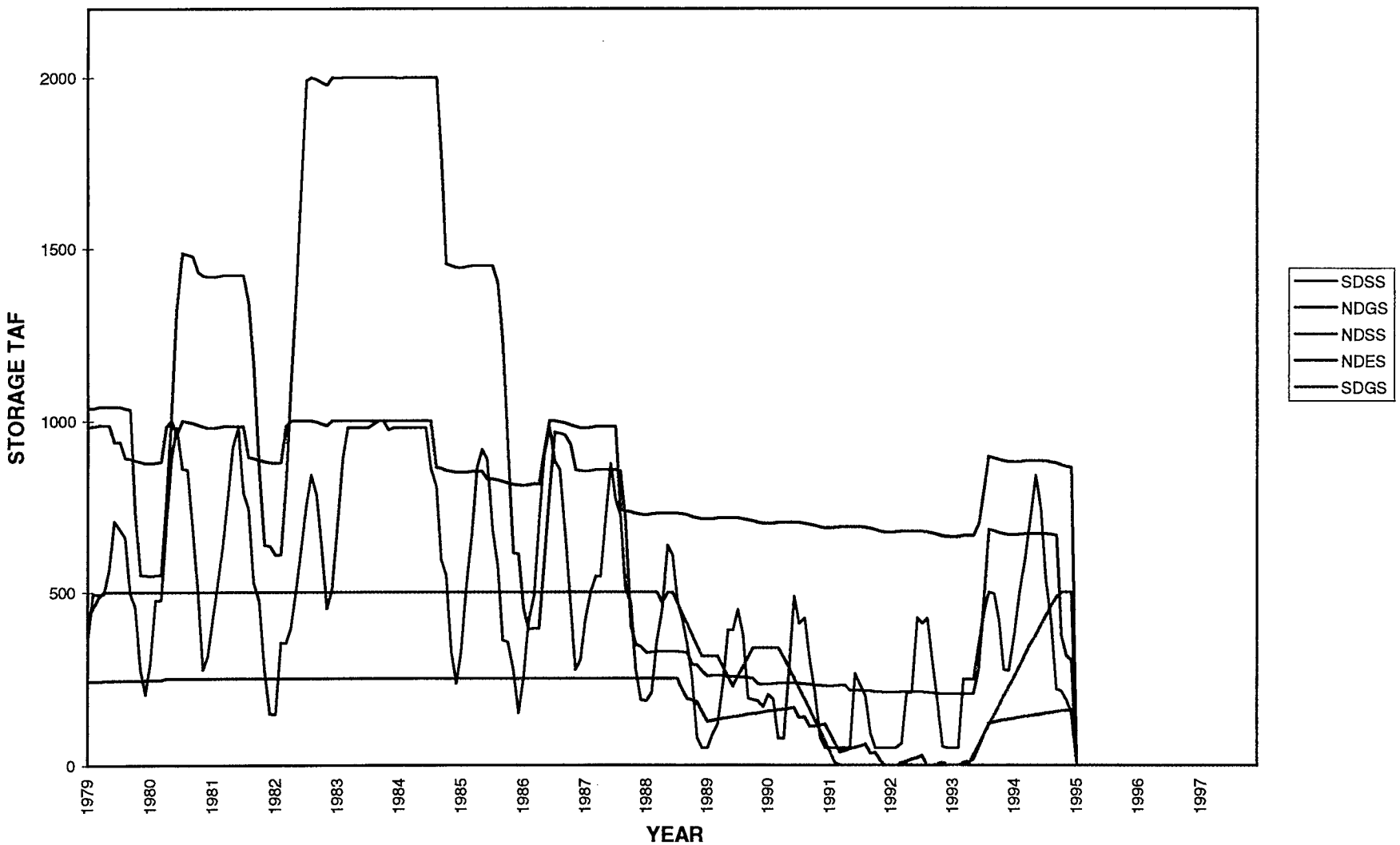


PRELIMINARY

SUBJECT TO REVISION

D-007894

END OF MONTH STORAGE SCENARIO 3 (2020d09a-calfed-531)



PRELIMINARY

SUBJECT TO REVISION

APPENDIX I

D-007896

PRELIMINARY DRAFT - SUBJECT TO REVISION

DWR PLANNING SIMULATION MODEL (DWRSIM) ASSUMPTIONS FOR CALFED BASE STUDY WITH D-1485 DELTA STANDARDS 2020D09A-CALFED-527

In addition to meeting D-1485 Delta standards, Base Study 527 meets selected upstream ESA requirements. This Study also incorporates 2020 level of hydrology, 2020 level of South-of-Delta SWP variable demands, and the current Stanislaus Operation.

I. New Model Features

A new DWRSIM version with the following enhancements is employed:

A. A new SWP and CVP south-of-Delta delivery logic uses (i) runoff forecast information and uncertainty (not perfect foresight), (ii) a delivery versus carryover risk curve and (iii) a standardized rule (Water Supply Index versus Demand Index Curve) to estimate the total water available for delivery and carryover storage. The new logic updates delivery levels monthly from January 1 through May 1 as water supply parameters become more certain. Refer to Leaf and Arora (1996) for additional information on the new delivery logic.

B. An expanded network schematic includes more details in the Delta and along the DMC and SWP-CVP Joint Reach facility.

C. A network representation of the San Joaquin River basin was adapted from USBR's SANJASM model. The San Joaquin River basin schematic was expanded to include (i) the Tuolumne River upstream to New Don Pedro Reservoir (ii) the Merced River upstream to Lake McClure, (iii) the Chowchilla and Fresno Rivers upstream to Eastman and Hensley Lakes, respectively, and (iv) the San Joaquin River upstream to Millerton Lake.

D. Contra Costa Water District's "G" model is used to relate Delta flows and salinities. Refer to Denton (1993) for additional information on the procedure.

E. New Melones operations criteria modeled per interim "New Melones Operations Plan" provided by USBR Staff.

F. Model modified to operate surface storages for environment use; and meeting the Ecosystem Restoration Program Plan (ERPP) flow targets.

G. References:

Leaf, R.T. and Arora, S.K. (1996). "Annual Delivery Decisions in the Simulation of the California State Water Project and Federal Central Valley Project using DWRSIM." *Proceedings 1996 North American Water and Environment Congress*, ASCE, C.T.

Bathala, Ed.

Denton, R.A. (1993). "Accounting for Antecedent Conditions in Seawater Intrusion Modeling - Applications for the San Francisco Bay-Delta." *Proceedings 1993 National Conference on Hydraulic Engineering*, ASCE, H.W. Shen, Ed.

II. Instream Flow Requirements

A. Trinity River minimum fish flows below Lewiston Dam are maintained at 340 TAF/year for all years, based on a May 1991 letter agreement between the USBR and the U.S. Fish and Wildlife Service.

B. Sacramento River navigation control point (NCP) flows are maintained at 5,000 cfs in wet and above normal water years and 4,000 cfs in all other years. This criterion is relaxed to 3,500 cfs when Shasta carryover storage drops below 1.9 MAF and is further relaxed to 3,250 cfs when Shasta carryover storage drops below 1.2 MAF.

C. Sacramento River minimum fishery flows below Keswick Dam are maintained per the Agreement between U.S. Bureau of Reclamation and California Department of Fish and Game (as revised October 1981). These flows range from 2300 to 3900 cfs, depending on the time of year per the U.S. Bureau"s Shasta criteria. Whiskeytown to Clear Creek releases are maintained under the same Agreement.

D. Feather River fishery flows are maintained per an agreement between DWR and the Calif. Dept. of Fish & Game (August 26, 1983). In normal years these minimum flows are 1,700 cfs from October through March and 1,000 cfs from April through September. Lower minimum flows are allowed in low runoff years and when Oroville storage drops below 1.5 MAF. A maximum flow restriction of 2,500 cfs for October and November is maintained per the agreement criteria.

E. Lower American River minimum fish and recreation flows are variable, and are determined based on the SWRCB Decision D-893 which imposed minimum fishery releases below Nimbus Dam on the American River.

F. Stanislaus River required minimum fish flows below New Melones Reservoir are met as a function of New Melones Reservoir storage and range from 98 TAF/year up to 467 TAF/year, according to the interim Operations Plan provided by USBR Staff. The actual minimum fish flow for each year is based on the water supply available for that year. CVP contract demands above Goodwin Dam are met as a function of New Melones Reservoir storage and inflow per interim Operations Plan provided by USBR Staff.

G. Tuolumne River minimum fishery flows below New Don Pedro Dam are maintained per an agreement between Turlock and Modesto Irrigation Districts, City of San Francisco, Dept. of Fish

& Game and others (FERC Agreement 2299). Base flows range from 50 cfs to 300 cfs. Base and pulse flow volumes depend on time of the year and water year type.

III. Trinity River Imports

Imports from Clair Engle Reservoir to Whiskeytown Reservoir (up to a 3,300 cfs maximum) are specified according to USBR criteria. Imports vary according to month and previous month Clair Engle storage.

IV. Hydrology (HYD-D09A)

A new 2020 level hydrology, HYD-D09a, has been developed similar to hydrology HYD-C09b described in a June 1994 memorandum report titled "Summary of Hydrologies at the 1990, 1995, 2000, 2010, and 2020 Levels of Development for Use in DWRSIM Planning Studies" published by DWR's Division of Planning (now Office of SWP Planning). HYD-D09a is based on DWR Bulletin 160-98 land use projections and simulates the 73 year period 1922 through 1994. Major assumptions in developing the hydrology compared to the 1995 level HYD-C06f are:

A. For areas upstream of the Delta (Sacramento River Basin and Eastside Stream area) land use projections at the 2020 level of development based on Bulletin 160-98 preliminary projections.

B. The stand-alone HEC-3 models of the American, Yuba, and Bear River systems were updated and extended through 1994.

C. A new EBMUD study (Study No. 5977) of the Camanche/Pardee reservoir system on the Mokelumne was used in the hydrology development process.

D. Net Delta water requirements were estimated based on variable crop ET values.

E. For the San Joaquin Valley, the hydrology was based on Bureau of Reclamation's SANJASM run NF1 used in the base case for the PEIS.

V. Pumping Plant Capacities, Coordinated Operation & Wheeling

A. SWP Banks Pumping Plant average monthly capacity with 4 new pumps is 6,680 cfs (or 8,500 cfs in some winter months) in accordance with USACE October 31, 1981 Public Notice criteria. Pumping is limited to 3,000 cfs in May and June and 4,600 cfs in July to comply with D-1485 criteria for striped bass survival. Additionally, per a January 5, 1987 interim agreement between DWR and the Calif. Department of Fish & Game, SWP pumping is limited to 2,000 cfs in any May or June in which storage withdrawals from Oroville Reservoir are required.

B. CVP Tracy Pumping Plant capacity is 4,600 cfs, but constraints along the Delta Mendota Canal and at the relift pumps (to O'Neil Forebay) can restrict export capacity as low as 4,200 cfs. Pumping is limited to 3,000 cfs in May and June in accordance with D-1485 criteria for striped bass survival.

C. CVP/SWP sharing of responsibility for the coordinated operation of the two projects is maintained per the Coordinated Operation Agreement (COA). Storage withdrawals for in-basin use are split 75 percent CVP and 25 percent SWP. Unstored flows for storage and export are split 55 percent CVP and 45 percent SWP. In months when the export-inflow ratio limits Delta exports, the allowable export is shared equally between the CVP and SWP. (The COA sharing formula is based on D-1485 operations, not on May 1995 Water Quality Control Plan operations. The sharing formula will likely be modified to conform with Water Quality Control Plan operations. Such a change has unknown, but potentially significant, operational implications.)

D. CVP water is wheeled to meet Cross Valley Canal demands when unused capacity is available in Banks Pumping Plant.

E. Enlarged East Branch aqueduct capacities are assumed from Alamo Powerplant to Devil Canyon Powerplant.

VI. Target Reservoir Storage

A. Shasta Reservoir carryover storage is maintained at or above 1.9 MAF in all normal water years for winter-run salmon protection per the NMFS biological opinion. However, in critical years following critical years, storage is allowed to fall below 1.9 MAF.

B. Folsom Reservoir storage capacity was reduced from 1010 TAF down to 975 TAF due to sediment accumulation as calculated from a 1992 reservoir capacity survey.

C. Folsom flood control criteria are in accordance with the December 1993 USACE report "Folsom Dam And Lake Operation Evaluation". This criteria uses available storage in upstream reservoirs such that the maximum flood control reservation varies from 400 TAF to 670 TAF.

VII. SWP Demands, Deliveries & Deficiencies

A. 2020 demand level is assumed to be variable at full entitlement of 4.2 MAF. MWDSC's monthly demand patterns assume an Eastside Reservoir and an Inland Feeder pipeline in accordance with a July 26, 1995 memorandum from MWDSC.

B. Deficiencies are imposed as needed per the draft "Monterey Agreement" criteria and are calculated from the following Table A entitlements for year 2020:

Agricultural Entitlements	1,150 TAF/year
M & I Entitlements	2,981
Recreation & Losses	64
Total Entitlements	4,195 TAF/year

C. Maximum SWP Contractor deliveries are designed to vary in response to local wetness indexes. As such, maximum deliveries are reduced in the wetter years, assuming greater availability of local water supplies.

1. Maximum deliveries to San Joaquin Valley agricultural contractors are reduced in wetter years using the following index developed from annual Kern River inflows to Lake Isabella:

	Dry/Avg/Above	Wet
Kern River flow (TAF/year)	<1,500	>1,500
Max. Ag delivery (TAF)	1,150	915

2. Maximum deliveries to Metropolitan Water District of Southern California (MWDSC) are varied annually in accordance with the July 11, 1997 transmittal from MWDSC to CALFED. These annual deliveries range between 1322 TAF/year to 2010 TAF/year.

3. Maximum deliveries to all other SWP M&I Contractors are NOT adjusted for a wetness index, and are set at 971 TAF/year in all years. As a result of the use of these wetness indexes and variable MWDASC demands, the total maximum delivery to all SWP Contractors varies by year as follows:

	Max	Min
Ag delivery	1,150	915
MWDSC delivery	2,010	1,322
Max. Other M&I delivery	971	971
Fixed Losses & Recreation	64	64
Total SWP Delivery	4,195	3,272

D. Maximum interruptible demand per month for SWP is assumed as follows.

MWDSC	50
Others	84
Total (Max)	134 TAF/month

In wet years when Kern River inflow to Lake Isabella is greater than 1500 TAF/year, there is no interruptible demand.

E. When available, "interruptible" water is delivered to SWP south-of-Delta contractors in

accordance with the following assumptions based on the Monterey Amendment White Paper redraft dated September 28, 1995:

1. Interruptible water results from direct diversions from Banks Pumping Plant. It is not stored in San Luis Reservoir for later delivery to contractors.

2. A contractor may accept interruptible water in addition to its monthly scheduled entitlement water. Therefore, the contractor may receive water above its Table A amount for the year. Interruptible water deliveries do not impact entitlement water allocations.

3. If demand for interruptible water is greater than supply in any month, the supply is allocated in proportion to the Table A entitlements of those contractors requesting interruptible water.

VIII. CVP Demands, Deliveries & Deficiencies

A. 2020 level CVP demands, including canal losses but excluding San Joaquin Valley wildlife refuges are assumed as follows (see Item IX.B below for refuge demands):

Contra Costa Canal	202 TAF/year
DMC and Exchange	1,561
CVP San Luis Unit	1,447
San Felipe Unit	196
Cross Valley Canal	128
Total CVP Delta Exports	3,534 TAF/year

Including wildlife refuges, total CVP demand is 3,822 TAF/year. The Contra Costa Canal monthly demand pattern assumes Los Vaqueros operations in accordance with a July 11, 1994 e-mail from CCWD.

B. Sacramento Valley refuge demands are modeled implicitly in the hydrology through rice field and duck club operations. Sacramento Valley refuges include Gray Lodge, Modoc, Sacramento, Delevan, Colusa and Sutter. Level II refuge demands in the San Joaquin Valley are explicitly modeled at an assigned level of 288 TAF/year. San Joaquin Valley refuges include Grasslands, Volta, Los Banos, Kesterson, San Luis, Mendota, Pixley, Kern and those included in the San Joaquin Basin Action Plan.

C. CVP south-of-Delta deficiencies are imposed when needed by contract priority. Contracts are classified into four groups: agricultural (Ag), municipal and industrial (M&I), Exchange and Refuge. Deficiencies are imposed in accordance with the Shasta Index and sequentially according to the following rules:

1. Ag requests are reduced up to a maximum of 50 percent.

2. Ag, M&I and Exchange requests are reduced by equal percentages up to a maximum of 25 percent. At this point, cumulative Ag deficiencies are 75 percent.

3. Ag, M&I and Refuge requests are reduced by equal percentages up to a maximum of 25 percent. At this point, cumulative Ag and M&I deficiencies are 100 percent and 50 percent, respectively.

4. M&I requests are reduced until cumulative deficiencies are 100 percent.

5. Further reductions are imposed equally upon Exchange and Refuge.

D. Deficiencies in the form of "dedicated" water and "acquired" water to meet 800 TAF/year CVPIA demands are not imposed.

IX. Delta Standards

A. Delta water quality standards are maintained at Contra Costa Canal intake (M&I), Emmaton and Jersey Point (agriculture), and Antioch, Chipps Island and Collinsville (fish & wildlife) in accordance with D-1485. A "buffer" was added to insure that the M&I standard at Contra Costa Canal is maintained on a daily basis. Thus, DWRSIM uses a value of 130 mg/L for the 150 mg/L standard and a value of 225 mg/L for the 250 mg/L standard. The following water quality objectives are not modeled:

1. the 250 mg/L M&I chloride standards at Cache Slough, Clifton Court Forebay and Tracy Pumping Plant

2. the agriculture EC standards on the Mokelumne River (at Terminous) and on the San Joaquin River (at San Andreas Landing)

3. the fish and wildlife EC standards on the San Joaquin River (at Prisoner's Point)

B. Minimum Sacramento River flow (at Rio Vista) and Delta outflow requirements (at Chipps Island) are maintained in accordance with D-1485. Water year classifications are determined using the Sacramento River Index as published in DWR Bulletin 120.

C. Delta cross channel gates are closed in January through May when the Delta Outflow Index is greater than 12,000 cfs in accordance with D-1485. Additionally, the gates are closed in any month when upstream Sacramento River flows are greater than 25,000 cfs.

D. The D-1422 San Joaquin River water quality objective at Vernalis (500 ppm TDS) is maintained by releasing water from New Melones Reservoir. A 70 TAF/year cap on reservoir releases is not imposed. If New Melones Reservoir storage drops to 80 TAF (per an April 26, 1996 letter from USBR to SWRCB), additional water is not provided for salinity control and the water quality standard is violated.

PRELIMINARY DRAFT - SUBJECT TO REVISION

DWR PLANNING SIMULATION MODEL (DWRSIM) ASSUMPTIONS FOR CALFED NEW BENCHMARK STUDY
2020D09A-CALFED-514

Study 514 meets SWRCB'S May 1995 Water Quality Control Plan (Plan) and includes selected upstream ESA requirements and CVPIA AFRP flow prescriptions (see Item III). This Study also incorporates 2020 level of hydrology, 2020 level of South-of-Delta SWP variable demands, and the current Stanislaus Operation.

I. New Model Features

A new DWRSIM version with the following enhancements is employed:

A. A new SWP and CVP south-of-Delta delivery logic uses (i) runoff forecast information and uncertainty (not perfect foresight), (ii) a delivery versus carryover risk curve and (iii) a standardized rule (Water Supply Index versus Demand Index Curve) to estimate the total water available for delivery and carryover storage. The new logic updates delivery levels monthly from January 1 through May 1 as water supply parameters become more certain. Refer to Leaf and Arora (1996) for additional information on the new delivery logic.

B. An expanded network schematic includes more details in the Delta and along the DMC and SWP-CVP Joint Reach facility.

C. A network representation of the San Joaquin River basin was adapted from USBR's SANJASM model. The San Joaquin River basin schematic was expanded to include (i) the Tuolumne River upstream to New Don Pedro Reservoir (ii) the Merced River upstream to Lake McClure, (iii) the Chowchilla and Fresno Rivers upstream to Eastman and Hensley Lakes, respectively, and (iv) the San Joaquin River upstream to Millerton Lake.

D. Contra Costa Water District's "G" model is used to relate Delta flows and salinities. Refer to Denton (1993) for additional information on the procedure.

E. New Melones operations criteria modeled per interim "New Melones Operations Plan" provided by USBR Staff.

F. Model modified to operate surface storages for environment use; and meeting the Ecosystem Restoration Program Plan (ERPP) flow targets.

G. References:

Leaf, R.T. and Arora, S.K. (1996). "Annual Delivery Decisions in the Simulation of the California State Water Project and Federal Central Valley Project using DWRSIM."

Proceedings 1996 North American Water and Environment Congress, ASCE, C.T. Bathala, Ed.

Denton, R.A. (1993). "Accounting for Antecedent Conditions in Seawater Intrusion Modeling - Applications for the San Francisco Bay-Delta." *Proceedings 1993 National Conference on Hydraulic Engineering*, ASCE, H.W. Shen, Ed.

II. Instream Flow Requirements

A. Trinity River minimum fish flows below Lewiston Dam are maintained at 340 TAF/year for all years, based on a May 1991 letter agreement between the USBR and the U.S. Fish and Wildlife Service.

B. Sacramento River navigation control point (NCP) flows are maintained at 5,000 cfs in wet and above normal water years and 4,000 cfs in all other years. This criterion is relaxed to 3,500 cfs when Shasta carryover storage drops below 1.9 MAF and is further relaxed to 3,250 cfs when Shasta carryover storage drops below 1.2 MAF.

C. Feather River fishery flows are maintained per an agreement between DWR and the Calif. Dept. of Fish & Game (August 26, 1983). In normal years these minimum flows are 1,700 cfs from October through March and 1,000 cfs from April through September. Lower minimum flows are allowed in low runoff years and when Oroville storage drops below 1.5 MAF. A maximum flow restriction of 2,500 cfs for October and November is maintained per the agreement criteria.

D. Stanislaus River required minimum fish flows below New Melones Reservoir are met as a function of New Melones Reservoir storage and range from 98 TAF/year up to 467 TAF/year, according to the interim Operations Plan provided by USBR Staff. The actual minimum fish flow for each year is based on the water supply available for that year. CVP contract demands above Goodwin Dam are met as a function of New Melones Reservoir storage and inflow per interim Operations Plan provided by USBR Staff.

E. Tuolumne River minimum fishery flows below New Don Pedro Dam are maintained per an agreement between Turlock and Modesto Irrigation Districts, City of San Francisco, Dept. of Fish & Game and others (FERC Agreement 2299). Base flows range from 50 cfs to 300 cfs. Base and pulse flow volumes depend on time of the year and water year type.

F. Instream flow requirements are maintained in accordance with CVPIA criteria (see Item III) at the following locations: below Keswick Dam on the Sacramento River, below Whiskeytown Dam on Clear Creek and below Nimbus Dam on the American River.

III. CVPIA AFRP Flow Criteria

The following AFRP flow criteria are in accordance with an April 26, 1996 letter from USBR to SWRCB. (This information is preliminary. It is envisioned that when significant changes occur within the CVP/SWP system, the criteria will be reviewed and possibly revised):

A. Flow objectives between 3,250 cfs and 5,500 cfs are maintained below Keswick Dam on the Sacramento River. Flow requirements during October through April are triggered by Shasta carryover storage.

B. Flow objectives between 52 cfs and 200 cfs are maintained below Whiskeytown Dam on Clear Creek, depending on month and year type.

C. Flow objectives between 250 cfs and 4,500 cfs are maintained below Nimbus Dam on the American River. Flow requirements during October through February are triggered by Folsom carryover storage. Flow requirements in other months are triggered by previous month storage plus remaining water year inflows.

IV. Trinity River Imports

Imports from Clair Engle Reservoir to Whiskeytown Reservoir (up to a 3,300 cfs maximum) are specified according to USBR criteria. Imports vary according to month and previous month Clair Engle storage.

V. Hydrology (HYD-D09A)

A new 2020 level hydrology, HYD-D09a, has been developed similar to hydrology HYD-C09b described in a June 1994 memorandum report titled "Summary of Hydrologies at the 1990, 1995, 2000, 2010, and 2020 Levels of Development for Use in DWRSIM Planning Studies" published by DWR's Division of Planning (now Office of SWP Planning). HYD-D09a is based on DWR Bulletin 160-98 land use projections and simulates the 73 year period 1922 through 1994. Major assumptions in developing the hydrology compared to the 1995 level HYD-C06f are:

A. For areas upstream of the Delta (Sacramento River Basin and Eastside Stream area) land use projections at the 2020 level of development based on Bulletin 160-98 preliminary projections.

B. The stand-alone HEC-3 models of the American, Yuba, and Bear River systems were updated and extended through 1994.

C. A new EBMUD study (Study No. 5977) of the Camanche/Pardee reservoir system on the Mokelumne was used in the hydrology development process.

D. Net Delta water requirements were estimated based on variable crop ET values.

E. For the San Joaquin Valley, the hydrology was based on Bureau of Reclamation's SANJASM run NF1 used in the base case for the PEIS.

VI. Pumping Plant Capacities, Coordinated Operation & Wheeling

A. SWP Banks Pumping Plant average monthly capacity with 4 new pumps is 6,680 cfs (or 8,500 cfs in some winter months) in accordance with USACE October 31, 1981 Public Notice criteria.

B. CVP Tracy Pumping Plant capacity is 4,600 cfs, but physical constraints along the Delta Mendota Canal and at the relift pumps (to O'Neil Forebay) can restrict export capacity as low as 4,200 cfs.

C. CVP/SWP sharing of responsibility for the coordinated operation of the two projects is maintained per the Coordinated Operation Agreement (COA). Storage withdrawals for in-basin use are split 75 percent CVP and 25 percent SWP. Unstored flows for storage and export are split 55 percent CVP and 45 percent SWP. In months when the export-inflow ratio limits Delta exports, the allowable export is shared equally between the CVP and SWP. (The COA sharing formula is based on D-1485 operations, not on May 1995 Water Quality Control Plan operations. The sharing formula will likely be modified to conform with Water Quality Control Plan operations. Such a change has unknown, but potentially significant, operational implications.)

D. CVP water is wheeled to meet Cross Valley Canal demands when unused capacity is available in Banks Pumping Plant.

E. Enlarged East Branch aqueduct capacities are assumed from Alamo Powerplant to Devil Canyon Powerplant.

VII. Target Reservoir Storage

A. Shasta Reservoir carryover storage is maintained at or above 1.9 MAF in all normal water years for winter-run salmon protection per the NMFS biological opinion. However, in critical years following critical years, storage is allowed to fall below 1.9 MAF.

B. Folsom Reservoir storage capacity was reduced from 1010 TAF down to 975 TAF due to sediment accumulation as calculated from a 1992 reservoir capacity survey.

C. Folsom flood control criteria are in accordance with the December 1993 USACE report "Folsom Dam And Lake Operation Evaluation". This criteria uses available storage in upstream reservoirs such that the maximum flood control reservation varies from 400 TAF to 670 TAF.

VIII. SWP Demands, Deliveries & Deficiencies

A. 2020 demand level is assumed to be variable at full entitlement of 4.2 MAF. MWDSC's monthly demand patterns assume an Eastside Reservoir and an Inland Feeder pipeline in accordance with a July 26, 1995 memorandum from MWDSC.

B. Deficiencies are imposed as needed per the draft "Monterey Agreement" criteria and are calculated from the following Table A entitlements for year 2020:

Agricultural Entitlements	1,150 TAF/year
M & I Entitlements	2,981
Recreation & Losses	64
Total Entitlements	4,195 TAF/year

C. Maximum SWP Contractor deliveries are designed to vary in response to local wetness indexes. As such, maximum deliveries are reduced in the wetter years, assuming greater availability of local water supplies.

1. Maximum deliveries to San Joaquin Valley agricultural contractors are reduced in wetter years using the following index developed from annual Kern River inflows to Lake Isabella:

	Dry/Avg/Above	Wet
Kern River flow (TAF/year)	<1,500	>1,500
Max. Ag delivery (TAF)	1,150	915

2. Maximum deliveries to Metropolitan Water District of Southern California (MWDSC) are varied annually in accordance with the July 11, 1997 transmittal from MWDSC to CALFED.These annual deliveries range between 1322 TAF/year to 2010 TAF/year.

3. Maximum deliveries to all other SWP M&I Contractors are NOT adjusted for a wetness index, and are set at 971 TAF/year in all years. As a result of the use of these wetness indexes and variable MWDASC demands, the total maximum delivery to all SWP Contractors varies by year as follows:

	Max	Min
Ag delivery	1,150	915
MWDSC delivery	2010	1,322
Max. Other M&I delivery	971	971
Fixed Losses & Recreation	64	64
Total SWP Delivery	4,195	3,272

D. Maximum interruptible demand per month for SWP is assumed as follows.

MWDSC	50
Others	84
Total (Max)	134 TAF/month

In wet years when Kern River inflow to Lake Isabella is greater than 1500 TAF/year, there is no interruptible demand.

E. When available, "interruptible" water is delivered to SWP south-of-Delta contractors in accordance with the following assumptions based on the Monterey Amendment White Paper redraft dated September 28, 1995:

1. Interruptible water results from direct diversions from Banks Pumping Plant. It is not stored in San Luis Reservoir for later delivery to contractors.

2. A contractor may accept interruptible water in addition to its monthly scheduled entitlement water. Therefore, the contractor may receive water above its Table A amount for the year. Interruptible water deliveries do not impact entitlement water allocations.

3. If demand for interruptible water is greater than supply in any month, the supply is allocated in proportion to the Table A entitlements of those contractors requesting interruptible water.

IX. CVP Demands, Deliveries & Deficiencies

A. 2020 level CVP demands, including canal losses but excluding San Joaquin Valley wildlife refuges are assumed as follows (see Item IX.B below for refuge demands):

Contra Costa Canal	=	202 TAF/year
DMC and Exchange	=	1,561
CVP San Luis Unit	=	1,447
San Felipe Unit	=	196
Cross Valley Canal	=	128
Total CVP Delta Exports	=	3,534 TAF/year

Including wildlife refuges, total CVP demand is 3,822 TAF/year. The Contra Costa Canal monthly demand pattern assumes Los Vaqueros operations in accordance with a July 11, 1994 e-mail from CCWD.

B. Sacramento Valley refuge demands are modeled implicitly in the hydrology through rice field and duck club operations. Sacramento Valley refuges include Gray Lodge, Modoc, Sacramento, Delevan, Colusa and Sutter. Level II refuge demands in the San Joaquin Valley are explicitly modeled at an assigned level of 288 TAF/year. San Joaquin Valley refuges include Grasslands, Volta, Los Banos, Kesterson, San Luis, Mendota, Pixley, Kern and those included in the San

Joaquin Basin Action Plan.

C. CVP south-of-Delta deficiencies are imposed when needed by contract priority. Contracts are classified into four groups: agricultural (Ag), municipal and industrial (M&I), Exchange and Refuge. Deficiencies are imposed in accordance with the Shasta Index and sequentially according to the following rules:

1. Ag requests are reduced up to a maximum of 50 percent.

2. Ag, M&I and Exchange requests are reduced by equal percentages up to a maximum of 25 percent. At this point, cumulative Ag deficiencies are 75 percent.

3. Ag, M&I and Refuge requests are reduced by equal percentages up to a maximum of 25 percent. At this point, cumulative Ag and M&I deficiencies are 100 percent and 50 percent, respectively.

4. M&I requests are reduced until cumulative deficiencies are 100 percent.

5. Further reductions are imposed equally upon Exchange and Refuge.

D. Deficiencies in the form of "dedicated" water and "acquired" water to meet 800 TAF/year CVPIA demands are not imposed.

X. Delta Standards

In the following assumptions related to Delta standards, reference is made to the SWRCB's May 1995 Water Quality Control Plan (Plan):

A. Water Year Classifications

1. The Sacramento Valley 40-30-30 Index (as defined on page 23 of the Plan) is used to determine year types for Delta outflow criteria and Sacramento River system requirements unless otherwise specified in the Plan.

2. The San Joaquin Valley 60-20-20 Index (page 24) is used to determine year types for flow requirements at Vernalis.

3. The Sacramento River Index, or SRI (Footnote 6, page 20), is used to trigger relaxation criteria related to May-June Net Delta Outflow Index (NDOI) and salinity in the San Joaquin River and western Suisun Marsh.

4. The Eight River Index (Footnote 13, page 20) is used to trigger criteria related to (i) January NDOI, (ii) February-June X2 standards and (iii) February export ratio.

B. M&I Water Quality Objectives (Table 1, page 16)

1. The water quality objective at Contra Costa Canal intake is maintained in accordance with the Plan. A "buffer" was added to insure that the standard is maintained on a daily basis. Thus, DWRSIM uses a value of 130 mg/L for the 150 mg/L standard and a value of 225 mg/L for the 250 mg/L standard.

2. The M&I water quality objectives at Clifton Court Forebay, Tracy Pumping Plant, Barker Slough and Cache Slough are not modeled.

C. Agricultural Water Quality Objectives (Table 2, page 17)

1. Water quality objectives on the Sacramento River at Emmaton and on the San Joaquin River at Jersey Point are maintained in accordance with the Plan.

2. Plan water quality objectives on the San Joaquin River at Vernalis are 0.7 EC in April through August and 1.0 EC in other months. These objectives are maintained primarily by releasing water from New Melones Reservoir. A cap on water quality releases is imposed per criteria outlined in an April 26, 1996 letter from USBR to SWRCB. The cap varies between 70 TAF/year and 200 TAF/year, depending on New Melones storage and projected inflow.

3. The interior Delta standards on the Mokelumne River (at Terminous) and on the San Joaquin River (at San Andreas Landing) are not modeled.

4. The export area 1.0 EC standards at Clifton Court Forebay and Tracy Pumping Plant are not modeled.

D. Fish & Wildlife Water Quality Objectives: Salinity (Table 3, page 18)

1. The 0.44 EC standard is maintained at Jersey Point in April and May of all but critical years. Per Footnote 6 (page 20), this criteria is dropped in May if the projected SRI is less than 8.1 MAF. The salinity requirement at Prisoners Point is not modeled.

2. The following EC standards are maintained at Collinsville for eastern Suisun Marsh salinity control:

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
EC - Ave. High Tide	19.0	15.5	15.5	12.5	8.0	8.0	11.0	11.0

The corresponding EC standards for other locations in the eastern and western Suisun Marsh are not modeled.

E. Fish & Wildlife Water Quality Objectives: Delta Outflow (Table 3, page 19)

D-007911

1. Minimum required NDOI (cfs) is maintained as follows:

Year Type	Oct	Nov	Dec	Jan	Feb-Jun	Jul	Aug	Sep
Wet	4,000	4,500	4,500	*	**	8,000	4,000	3,000
Above Normal	4,000	4,500	4,500	*	**	8,000	4,000	3,000
Below Normal	4,000	4,500	4,500	*	**	6,500	4,000	3,000
Dry	4,000	4,500	4,500	*	**	5,000	3,500	3,000
Critical	3,000	3,500	3,500	*	**	4,000	3,000	3,000

* January: Maintain either 4,500 cfs or 6,000 cfs if the December Eight River Index was greater than 800 TAF (per Footnote 13 page 20).

** February-June: Maintain 2.64 EC standards (X2) as described below.

2. For February through June, outflow requirements are maintained in accordance with the 2.64 EC criteria (also known as X2) using the required number of days at Chipps Island (74 km) and Roe Island (64 km). See Footnote 14 for Table 3 (Table A) page 26.

a. At the Confluence (81 km), the full 150 days (February 1 - June 30) of 2.64 EC is maintained in all years, up to a maximum required flow of 7,100 cfs. This requirement is dropped in May and June of any year for which the projected SRI is less than 8.1 MAF. In those years when the criteria is dropped, a minimum outflow of 4,000 cfs is maintained in May and June.

b. The criteria -- "If salinity/flow objectives are met for a greater number of days than the requirements for any month, the excess days shall be applied to meeting the requirements for the following month" -- is not modeled. See Footnote "a" of Footnote 14 for Table 3 (Table A).

c. The Kimmerer-Monismith monthly equation is used to calculate outflow required (in cfs) to maintain the EC standard (average monthly position in kilometers). In this equation the EC position is given and Delta outflow is solved for.

$$\text{EC position} = 122.2 + [0.3278 * (\text{previous month EC position in km})] - [17.65 * \log_{10}(\text{current month Delta outflow in cfs})]$$

In months when the EC standard is specified in more than one location (e.g. 19 days at the confluence and 12 days at Chipps Island), required outflow for the month is computed as a flow weighted average of the partial month standards.

3. Additional details on the 2.64 EC criteria are modeled as follows:

a. The trigger to activate the Roe Island standard is set at 66.3 km from the previous month, as an average monthly value.

b. The maximum required monthly outflows to meet the 2.64 EC standard are capped at the following limits: 29,200 cfs for Roe Island; 11,400 cfs for Chipps Island; and 7,100 cfs for the Confluence.

c. Relaxation criteria for the February Chipps Island standard is a function of the January Eight River Index as follows:

(i) X2 days = 0 if the Index is less than 0.8 MAF
(ii) X2 days = 28 if the Index is greater than 1.0 MAF
(iii) X2 days vary linearly between 0 and 28 if the Index is between 0.8 MAF and 1.0 MAF

F. Fish & Wildlife Water Quality Objectives: River Flows (Table 3, page 19)

1. Minimum Sacramento River flow requirements (cfs) at Rio Vista are maintained as follows:

Year Type	Sep	Oct	Nov	Dec
Wet	3,000	4,000	4,500	4,500
Above Normal	3,000	4,000	4,500	4,500
Below Normal	3,000	4,000	4,500	4,500
Dry	3,000	4,000	4,500	4,500
Critical	3,000	3,000	3,500	3,500

2. From February 1 through June 30, minimum flows on the San Joaquin River at Vernalis are maintained per the table below. For each period, the higher flow is required whenever the 2.64 EC Delta outflow position is located downstream of Chipps Island (<74 km). If the 2.64 EC Delta outflow position is upstream of Chipps Island (>74 km), then the lower flow requirement is used.

	Minimum Flows at Vernalis (cfs)	
	Feb1-Apr14 &	
Year Type	May16-June30	April15-May15
Wet	2,130 or 3,420	7,330 or 8,620
Above Normal	2,130 or 3,420	5,730 or 7,020
Below Normal	1,420 or 2,280	4,620 or 5,480
Dry	1,420 or 2,280	4,020 or 4,880
Critical	710 or 1,140	3,110 or 3,540

3. For the month of October, the minimum flow requirement at Vernalis is 1,000 cfs in all years PLUS a 28 TAF pulse flow (per Footnote 19, page 21). The 28 TAF pulse

(equivalent to 455 cfs monthly) is added to the actual Vernalis flow, up to a maximum of 2,000 cfs. The pulse flow requirement is not imposed in a critical year following a critical year. These two components are combined as an average monthly requirement as follows:

October Minimum Flows at Vernalis (cfs)

Base Flow	Required Flow
<1,000	1,455
1,000-1,545	Base Flow + 455
>1,545	2,000

4. The above flow requirements at Vernalis are maintained primarily by releasing additional water from New Melones Reservoir. In years when New Melones Reservoir drops to a minimum storage of 80 TAF (per April 26, 1996 letter from USBR to SWRCB), additional water is provided equally from the Tuolumne and Merced River systems to meet the Vernalis flow requirements. If these sources are insufficient to meet objectives at Vernalis, nominal deficiencies will be applied to upstream demands.

G. Fish & Wildlife Water Quality Objectives: Export Limits (Table 3, page 19)

1. Ratios for maximum allowable Delta exports are specified as a percentage of total Delta inflow as follows:

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
65	65	65	65	45-35	35	35	35	35	65	65	65

a. In February the export ratio is a function of the January Eight River Index per Footnote 25, page 22 as follows:

(i) 45% if the Jan. 8-River Index is less than 1.0 MAF
(ii) 35% if the Jan. 8-River Index is greater than 1.5 MAF
(iii) Varies linearly between 45% and 35% if the January Eight River Index is between 1.0 MAF and 1.5 MAF.

b. For this ratio criteria, total Delta exports are defined as the sum of pumping at the SWP Banks and CVP Tracy Pumping Plants. Total Delta inflow is calculated as the sum of river flows from the Sacramento River, Yolo Bypass, total from the Eastside stream group, and San Joaquin River inflow. Delta area precipitation and consumptive uses are not used in this ratio.

2. Based on Footnote 22 page 21, April and May total Delta export limitations are modeled as follows:

a. April 15 - May 15 exports are limited to 1,500 cfs OR 100 percent of the San

Joaquin River flow at Vernalis, whichever is greater.

b. April 1-14 and May 16-31 export limits are controlled by either the export/inflow ratio (35%) or pumping plant capacity, whichever is smaller.

H. Fish & Wildlife Water Quality Objectives: Delta Cross Channel (Table 3, page 19)

1. The Delta Cross Channel (DCC) is closed 10 days in November, 15 days in December and 20 days in January for a total closure of 45 days per Footnote 26, page 22.

2. The DCC is fully closed from February 1 through May 20 of all years and is closed an additional 14 days between May 21 and June 15 per Footnote 27, page 22.

PRELIMINARY DRAFT - SUBJECT TO REVISION

DWR PLANNING SIMULATION MODEL (DWRSIM) ASSUMPTIONS FOR CALFED NEW BENCHMARK REOPERATION (SCENARIO 1C) STUDY 2020D09A-CALFED-515

Study 514 (New Benchmark) assumptions are modified as follows:

1. Unmet CVP demands from Study 514 (maximum annual capped at 500 TAF) are imposed as additional demand on the SWP system.

2. CVP water is wheeled through Banks Pumping Plant to meet unmet demands and to fill San Luis Reservoir when capacity is available.

PRELIMINARY DRAFT - SUBJECT TO REVISION

DWR PLANNING SIMULATION MODEL (DWRSIM) ASSUMPTIONS FOR CALFED NEW BENCHMARK REOPERATION (SCENARIO 1B) STUDY

2020D09A-CALFED-515a

Study 514 (New Benchmark) assumptions are modified as follows:

- CVP water is wheeled through Banks Pumping Plant to meet unmet demands and to fill San Luis Reservoir when capacity is available.

D-007917

PRELIMINARY DRAFT - SUBJECT TO REVISION

DWR PLANNING SIMULATION MODEL (DWRSIM) ASSUMPTIONS FOR CALFED NO ACTION (SCENARIO 1E) STUDY 2020D09A-CALFED-516

Study 514 (New Benchmark) assumptions are modified as follows:

A. Additional CVPIA(b)(2) AFRP flow action on the Stanislaus River below Goodwin Dam, is included per Table III-5 (Page III-12) PEIS Administrative Draft Report.

B. The following CVPIA(b)(2) water management Delta actions from the CVPIA PEIS Administrative Draft Report are incorporated.

1. Total CVP/SWP exports are restricted during the 30-day pulse flow period from April 15 through May 15 to the following ratios of total export to flow at Vernalis for the following year types.

   1:3 below normal, dry, and critical years
   1:4 above normal years
   1:5 wet years

2. Delta Cross Channel is closed during the period from November through June, and is open during the period from July through October.

3. Additional Chipps Island X2 days required to approximate a 1962 Level of Development are assumed as described in Table III-14 (Page III-29) PEIS Administrative Draft.

PRELIMINARY DRAFT - SUBJECT TO REVISION

DWR PLANNING SIMULATION MODEL (DWRSIM) ASSUMPTIONS FOR CALFED NO ACTION (SCENARIO 1D) STUDY

2020D09A-CALFED-516a

Study 514 (New Benchmark) assumptions are modified as follows:

The following CVPIA(b)(2) water management Delta actions from the CVPIA PEIS Administrative Draft Report are incorporated.

1. Total CVP/SWP exports are restricted during the 30-day pulse flow period from April 15 through May 15 to the following ratios of total export to flow at Vernalis for the following year types.

   1:3 below normal, dry, and critical years
   1:4 above normal years
   1:5 wet years

2. Delta Cross Channel is closed during the period from November through June, and is open during the period from July through October.

3. Additional Chipps Island X2 days required to approximate a 1962 Level of Development are assumed as described in Table III-14 (Page III-29) PEIS Administrative Draft.

D-007919

PRELIMINARY DRAFT - SUBJECT TO REVISION

DWR PLANNING SIMULATION MODEL (DWRSIM) ASSUMPTIONS FOR CALFED NO ACTION REOPERATION (SCENARIO 1F) STUDY

2020D09A-CALFED-517

Study 516 (No Action Scenario 1e) assumptions are modified as follows:

1. Unmet CVP demands from Study 516 (maximum annual capped at 500 TAF) are imposed as additional demand on the SWP system.

2. CVP water is wheeled through Banks Pumping Plant to meet unmet demands and to fill San Luis Reservoir when capacity is available.

PRELIMINARY DRAFT - SUBJECT TO REVISION

DWR PLANNING SIMULATION MODEL (DWRSIM) ASSUMPTIONS FOR CALFED NO ACTION REOPERATION - ERPP (SCENARIO 1G) STUDY 2020D09A-CALFED-518

Study 516 (No Action Scenario 1e) assumptions are modified as follows:

1. Unmet CVP demands from Study 516 (maximum annual capped at 500 TAF) are imposed as additional demand on the SWP system.

2. CVP water is wheeled through Banks Pumping Plant to meet unmet demands and to fill San Luis Reservoir when capacity is available.

3. Ecosystem Restoration Program Plan (ERPP) flow targets are assumed as specified in CALFED System Operation Modeling Plan Report dated August 21, 1997.

4. ERPP water for instream flows and Delta outflow targets are available only for environmental uses.

5. Implementation of ERPP targets will not impact the project operations. ERPP flows are added to the system in each monthly time step, after simulation of SWP and CVP operations. Shortfalls in ERPP flow are made up through an "add water" function, to simulate acquisitions from willing sellers.

PRELIMINARY DRAFT - SUBJECT TO REVISION

DWR PLANNING SIMULATION MODEL (DWRSIM) ASSUMPTIONS FOR CALFED NEW FACILITY - SDI (SCENARIO 2) STUDY 2020D09A-CALFED-528

Study 516 (No Action Scenario 1e) assumptions are modified as follows:

1. Unmet CVP demands from Study 516 (maximum annual capped at 500 TAF) are imposed as additional demand on the SWP system.

2. CVP water is wheeled through Banks Pumping Plant to meet unmet demands and to fill San Luis Reservoir when capacity is available.

3. Ecosystem Restoration Program Plan (ERPP) flow targets are assumed as specified in CALFED System Operation Modeling Plan Report dated August 21, 1997.

4. ERPP water for instream flows and Delta outflow targets are available only for environmental uses.

5. Implementation of ERPP targets will not impact the project operations. ERPP flows are added to the system in each monthly time step, after simulation of SWP and CVP operations. Shortfalls in ERPP flow are made up through an "add water" function, to simulate acquisitions from willing sellers.

6. H.O. Banks Pumping Plant Improvements for facilities required to obtain USCOE Permit to operate Banks Pumping Plant at 10,300 cfs capacity, are assumed.

PRELIMINARY DRAFT - SUBJECT TO REVISION

DWR PLANNING SIMULATION MODEL (DWRSIM) ASSUMPTIONS FOR CALFED 5,000 cfs ISOLATED FACILITY (SCENARIO 6) STUDY

2020D09A-CALFED-529

Study 516 (No Action - Scenario 1e) assumptions are modified as follows:

I. H.O. Banks Pumping Plant Improvements

Facilities required to operate Banks Pumping Plant at 10,300 cfs capacity are assumed.

II. Isolated Component of Dual Transfer Facility

The Isolated Component of the Dual Transfer Facility (i.e. the Isolated Facility) is operated to maximize water quality benefits. In other words, the maximum amount of water is diverted into the Facility regardless of any additional upstream releases that may be required. Diversion into the Isolated Facility is governed by the following operations criteria:

A. Minimum Thru-Delta Conveyance: This is a user-specified minimum export that must be diverted from Delta channels before diversions through the Isolated Facility can be made. In Study 529, this minimum thru-Delta conveyance is specified as 1,000 cfs for the periods from October through March and July through September. There is no diversion from April to June.

B. Maximum Allowable Conveyance Through the Isolated Facility: This is a user-specified fraction of the net export (Banks and Tracy) that can be transferred through the Isolated Facility. In Study 529, this maximum allowable conveyance is 100% of the IF capacity.

C. Isolated Facility Capacity Constraint: This is the user-specified physical capacity of the Isolated Facility. In Study 529, the physical capacity is specified as 5,000 cfs.

D. Service to SWP Only: This is a user-specified option to operate the facility only for SWP net export. If selected, conveyance through the Isolated Facility is further limited to the SWP net export, excluding wheeling for the CVP. In Study 529, the Isolated Facility serves both the SWP and CVP.

E. Export Ratio Restrictions: This is a user-specified option that allows Isolated Facility conveyance to be included or excluded from Delta "inflow" and "export" computations for the February-June export restriction and the April-May export restriction. In Study 529, the Isolated Facility conveyance is included from export restrictions.

III. Delta Cross Channel Operations

The Delta Cross Channel is closed every day during the months of September through June and open from July through August, to minimize water costs associated with Isolated Facility conveyance.

D-007924

PRELIMINARY DRAFT - SUBJECT TO REVISION

DWR PLANNING SIMULATION MODEL (DWRSIM) ASSUMPTIONS FOR CALFED NEW FACILITIES SDI + SDSS (SCENARIO 5) STUDY

2020D09A-CALFED-530

Study 516 (No Action - Scenario 1e) assumptions are modified as follows:

I. H.O. Banks Pumping Plant Improvements

Facilities required to operate Banks Pumping Plant at 10,300 cfs capacity are assumed.

II. South of Delta Surface Storage

The South of Delta Surface Storage facility (SDSS) is assumed to have a storage capacity of 2.0 MAF with an inlet/outlet capacity of 3,500 cfs. SDSS operations are based on the following criteria:

A. The order of priority for storage releases is SDSS followed by SWP San Luis Reservoir.

B. The order of priority for storage diversions is SDSS followed by SWP San Luis Reservoir.

C. SDSS and SWP San Luis operations (releases and diversions) are balanced.

D. SDSS and SWP San Luis operations are triggered by combined south of Delta target storage. This combined storage is filled during some high outflow periods and with storage transfers from upstream reservoirs.

PRELIMINARY DRAFT - SUBJECT TO REVISION

DWR PLANNING SIMULATION MODEL (DWRSIM) ASSUMPTIONS FOR CALFED SDI+NDSS+NDGS+SDSS+SDGS (SCENARIO 3) STUDY 2020D09A-CALFED-531

Study 516 (No Action - Scenario 1e) assumptions are modified as follows:

I. H.O. Banks Pumping Plant Improvements

Facilities required to operate Banks Pumping Plant at 10,300 cfs capacity are assumed.

II. North Delta Surface Storage

Total new surface storage capacity of 3.0 MAF is assumed to be made up of North of Delta Surface Storage (NDSS) of 2.0 MAF for water supply purposes and North of Delta Environmental Storage (NDES) of 1.0 MAF for environmental purposes. Inlet and outlet flow capacity is assumed to be 5,000 cfs. Storage operations are based on the following criteria:

A. Storage releases from NDSS and NDES are restricted as follows:

1. Storage releases from NDSS and Oroville are made only to satisfy the SWP share of Delta in-basin requirements and SWP export.

2. Storage releases from NDSS and Oroville are balanced through user-specified HEC logical levels.

3. Storage releases from NDES are made for ERPP demand only.

B. Diversions to NDSS and NDES are restricted as follows:

1. In each water year, diversions to NDSS and NDES are not permitted until a monthly flushing volume of at least 1500 TAF occurs at the facility's diversion point. In determining the allowable NDSS and NDES diversion for the month in which the flushing volume occurs, only Sacramento River flow in excess of the 1500 TAF/month flow is considered for use in filling the facility.

2. Total diversion from the Sacramento River is proportioned internally by the model in 2/3 for NDSS and 1/3 for NDES diversion.

2. In any month that storage releases are being made to satisfy Delta in-basin requirements, diversions to NDSS or NDSS are not permitted.

3. Only surplus flows that are in excess of the export ratio requirement are considered for

use in filling the facility.

III. South of Delta Surface Storage

The South of Delta Surface Storage facility (SDSS) is assumed to have a storage capacity of 1.0 MAF with an inlet/outlet capacity of 3,500 cfs. SDSS operations are based on the following criteria:

A. The order of priority for storage releases is SDSS followed by SWP San Luis Reservoir.

B. The order of priority for storage diversions is SDSS followed by SWP San Luis Reservoir.

C. SDSS and SWP San Luis operations (releases and diversions) are balanced.

D. SDSS and SWP San Luis operations are triggered by combined south of Delta target storage. This combined storage is filled during some high outflow periods and with storage transfers from upstream reservoirs.

IV. Groundwater Storage

1. North of Delta Groundwater Storage facility (NDGS) is assumed to have a storage capacity of 0.25 MAF with inlet and outlet capacities of 500 cfs.

2. South of Delta Groundwater Storage facility (NDGS) is assumed to have a storage capacity of 0.25 MAF with inlet and outlet capacities of 500 cfs.

PRINTED BY
DEPARTMENT OF WATER RESOURCES
REPROGRAPHICS